

Sanitized Copy Approved for Release 2010/07/28 : CIA-RDP81-01043R000600010001-9

50X1-HUM

Page Denied

Next 2 Page(s) In Document Denied

Sanitized Copy Approved for Release 2010/07/28 : CIA-RDP81-01043R000600010001-9

POOR ORIGINAL

For our Soviet Fatherland!

HERALD OF THE AIR FORCE

MONTHLY JOURNAL OF THE MILITARY AIR FORCE
OF THE SOVIET ARMY

Thirty-Seventh Year of Publication

4
April

War Publishing House
of the Ministry of Defense of the USSR
Moscow - 1955

STAT

POOR ORIGINAL

THE GREAT POWER OF LENIN'S CONCEPTS ON THE DEFENSE OF A SOCIALIST STATE

On 22 April 1955, the 85th anniversary of the birth of Vladimir Il'ich Lenin - the greatest genius of the Revolution, the leader and teacher of the working people of all countries, the creator and founder of the Communist Party of the USSR and of the world's first socialist state, will be observed.

The people of our country and all mankind solemnly celebrate this glorious date. With pride and reverence they preserve in their hearts the dear and beloved image of V.I. Lenin, whose heroic and virile life, ingenious intelligence, strong will power and revolutionary passions were entirely devoted to the ideas of the working class, for the purpose of liberating the working masses from the yoke of the capital.

The Soviet government pays respect to the great leader and teacher, V.I. Lenin, observing his day of birth at its zenith of strength and a new powerful uptrend. Many outstanding victories have been achieved in all branches of communist building.

The complete history of the Soviet State, the entire road of development of the Soviet country are closely connected with Lenin's name, with his eternally active, life-consolidating doctrine - Leninism.

To Vladimir Il'ich Lenin goes credit for the idea of the defense of the socialist fatherland, one of his great services offered to our country. He indicated that any revolution is useful only if able to assert itself. Being a great patriot of his native land, nursing a hallowed hostility toward its enemies, he tirelessly indoctrinated his people with this noble and eminent feeling.

POOR ORIGINAL

Brilliantly foreseeing the entire course of the socialist revolution, Lenin as early as 1916, in his work "War Program of the Proletariat Revolution", thoroughly substantiated a status defining the armed defense of the conquests made by the proletariat revolution. After the victorious Great October Revolution, the idea of defending the socialist native land acquired more actual meaning, since now it reflected the vital interest of all the liberated nations of the Soviet Republic.

The birth of a new, genuine socialist state placed before the Soviet people, as one of the most important problems, the problem of defense and protection of their country, in view of the fact that world imperialism was preparing for an offensive on the first Soviet state of the world. That is why V.I. Lenin stated in 1918: "We, the defenders since after the 25th of October of 1917, have won the right to defend our country... we are defending our Fatherland from imperialists", and proudly declared: "We, the workers and peasants, can say to ourselves and to all the world, and are able to prove it, that we shall rise as one man to the defense of the Soviet Republic...". Two years later, Vladimir Il'ich, with the passion natural to him, underlined this thought again: "The Russia which liberated itself which, during a two-year suffering gave birth to its Soviet revolution, this Russia we are going to defend with the last drop of blood."

Lenin's concepts on the defense of the Socialist Fatherland, the affirmation that states that without armed defense of the socialist republic we would be unable to survive, deeply influenced the people's conscience and he, since the first days of the fight for freedom and independence of our country, proved himself a persistent and manful fighter.

To be able to defend one's own country from imperialist aggression and attack, it is necessary to have a strong army. For this reason, the Communist Party, immediately after the power of government was seized by the proletariat and after the Soviet government was established, tackled the problem of organizing the Armed Forces of the Soviet country.

The Communist Party, after accomplishing a gigantic organization and political-

POOR ORIGINAL

educational work, organized a strong well-trained army, the army of liberated workmen and peasants, the army defending the freedom and independence of our country, the army brought up in the spirit of internationalism.

On 26 January 1918, Lenin signed a historic decree on the organization of the Red Army of Workers and Peasants. On 14 February 1918, the Soviet government confirmed the decree of the organization of the Red Navy of Workers and Peasants. During the turbulent Eighteens, also the Soviet Air Force was organized.

Still in the beginning of the Civil War, during the most difficult time of our country, the Air Force of the Soviet Republic consisted of 62 units, employing several hundred airplanes. The years of the Civil War and foreign intervention are characterized by a firm policy of broad development of Soviet aviation on a firm scientific basis. Following the directions of V.I. Lenin, our country developed a system of scientific aeronautics research and educational institutes. The first aircraft factories had appeared.

From the first days of its existence, the Soviet Army unwaveringly served the interest of the people. The Soviet people kept the Army well supplied with all necessary means and resources, constantly reinforcing it with the best flower of its youth. Great love, fatherly care, and dependable help extended by the entire population imparted to the Soviet Army tremendous strength and an ever progressing will for victory.

After the Civil War was won, our victorious people under the direction of the Communist Party started peaceful creative work. However, the danger of a new imperialist attack on the Soviet country continued to exist. Lenin warned the Soviet people that, after successfully terminating the first series of wars we have to be prepared to fight the next; since the time of the next war is unknown we must always be ready to meet it. He, as before, exerted tireless care in establishing the defense system of the country.

Vladimir Il'ich Lenin developed an ingenious scientifically-substantiated plan for the building of Socialism. The plan included the most important problem of the

POOR ORIGINAL

building: industrialization of the country, electrification of the entire economy, reorganization of agriculture on a socialist basis, accomplishment of the cultural revolution. The industrialization of the country was considered by Lenin the basis of its future economic power and defensibility and, consequently, as one of the most important parts of the program.

The Communist party, after accepting Lenin's program for the organization of Socialism, initiated a tremendous movement of socialist build-up. As a result, in a historically short period, unbelievable socialist transformations were accomplished. Our native land, previously an economically backward agricultural country, was transformed into a powerful industrial-collective farming institution. Under the banner of Leninism, under the leadership of the Party and its central committee with I.V. Stalin at the top, our country entered the socialist phase.

The realization of the Lenin policy of industrialization in our country created the basis for technical rearmament of the Red Army and Navy. On completion of the first five-Year Plan, our country was capable of producing modern combat weapons. Our Armed Forces were receiving first-rate tanks and artillery, machine guns of all kinds and other weapons in sufficient quantities. The aircraft industry in our country was organized, leading to the creation of a powerful Air Force.

During the years of the Five-Year Plan, the Party not only took care of equipping the Army with newest combat technique and weapons, but also of training the military personnel who were devoted to their native land and its highly qualified masters. The territory principle of personnel replacement in the Army was substituted by the personnel method. The unified command system was introduced. Great attention was paid to the combat training and idealistic-political education of the Armed Forces personnel.

The Communist Party and Soviet government have also solved the problem of training the numerous pilots in properly utilizing the great technological advances offered them by the people. Soviet pilots established a series of world records, and our native country became not only the birth place but the foremost leader of

POOR ORIGINAL

world aviation.

The Soviet Union, while fighting for Socialism, had undergone many trials, and the Great Patriotic War was one of the most exhausting. Our socialist country won a cruel and bloody conflict, fought hand-to-hand with a strong and treacherous enemy - German Fascism.

As a result of the sudden and treacherous attack of Fascist Germany on the Soviet Union and an unfavorable ratio of forces, the Soviet Army was forced to retreat, leaving vitally important regions of our country to the enemy.

Despite difficult circumstances existing at the beginning of the war, the Soviet Army was virile and strong enough to upset the plans of the "Hitler" and to change the war situation in our favor. This is how it happened: first the enemy was brought to a stop and later it was subjected to successive, powerful attacks, which were followed by our historic victory. The victory in the Patriotic War was the victory of the social government and Soviet regime created by Lenin's genius, and the Communist Party was in the role of inspirator and organizer of the victory.

During the Great Patriotic War, the high combat qualities of the Soviet soldier became clearly evident. They were mentioned by Lenin and constantly improved by the Communist Party in the entire Soviet population: bravery, courage, fearless behavior in combat, and the resolution to fight to the victorious end against the enemies of our country.

Soviet soldiers, firmly believing in our final victory, courageously fought for their country. This was demonstrated by the immortal valor of Aleksander Matrosov, Nikolaya Gastello and many others, whose names became the pride of all the Soviet people. Love for their native country led them toward achievement and they fought under the immortal banner of Lenin.

Soviet pilots fought many air battles but no difficulties were great enough to break their will for victory. They were victorious in fights when outnumbered by the enemy, showed creative thinking and initiative in any complicated situation. Many of our pilot fighters shot down tens of enemy planes. Bomber pilots daringly

penetrated deep into the rear and attacked armies of the enemy. Neither strong anti-aircraft artillery fire nor anti-aircraft formations of the enemy could stop the Soviet soldiers, inspired by the glorious ideal of defending the socialist Fatherland.

In giving an evaluation of the combat activity of Soviet aviation during the war years, Stalin wrote in one of his citations:

"In the Great Patriotic War fought by the Soviet people against Fascist Germany, our aviation honorably fulfilled its duty to the Fatherland..."

The Great Patriotic War once again strongly confirmed the great value of Lenin's plan for industrialization of the country. Exactly because of the successful application of Lenin's policy in the field of industrialization, our country at the time it entered the war, was strong and powerful. With the help of the progressing industry, our country supplied the Soviet Army with the best modern weapons and everything required for victory. Toward the end of the Patriotic War, the Soviet Army had, compared to peacetime strength, 5 times as much artillery, 15 times as many tanks, and 5 times as many airplanes. In the famous battle for Berlin, 41,000 artillery guns and mortars, 8400 airplanes, more than 6300 first-rate tanks, and other combat devices were thrown into action on the Soviet side.

After the war, our country while doctoring the wounds inflicted by the enemy, successfully accomplished the program of communist build-up. Soviet economics is advancing in great strides. The well-being of the Soviet people is constantly growing. The Plenum of the Central Committee of the Communist Party, which took place in January 1955, indicated that the most important problem of the general policy of the Party is the fight for the further constant development of the socialist industry.

"The Communist Party, following the doctrine of the great Lenin, with respect to all possible development of heavy industry and electrification of the country," - states the resolution of the Plenum of the CPSU, - "considers, as before, that the further progress of heavy industry, which is a stable basis for the entire national

economy and defense of our country and a source of constant increase in the welfare of the Soviet people is the most important problem."

The general line of the policy of the Party finds its concrete realization in the everyday policy of communist building. The recently conducted Second Session of the Supreme Soviet of the USSR, unanimously accepted a law on the State Budget of the USSR for 1955. Of the entire sum allotted to all branches of industry of 189.6 billion rubles, a total of 163.6 billion are assigned to the development of the steel, coal, oil, chemical, machine industry, public utilities, and other branches. These large-scale allotments will help maintain the high rate of development of heavy industry.

Never before was our country as powerful as it is now, never before was its international position as strong as it is now. Now the Soviet Union has international relations different from those existing before the war. We can no longer speak about the USSR and capitalistic surroundings in the same sense it was spoken of before the war. The international isolation of our country has become obsolete. The creation of a world socialist camp, with the USSR and the Chinese National Republic at the head, was the most important result of World War II.

It is natural that in connection with the changes in the world situation, the balance of forces between the social systems, especially during the last ten-year period, definitely has changed in favor of socialism.

Intensive and productive work is in progress in all corners of our country. Creative, inspired work, for the benefit of our country, is an important part of the life of every Soviet citizen. At the same time, the Soviet people religiously guard its sacred possessions.

Lenin's idea of defense of the socialist Fatherland became a vital law of the Soviet people, their first patriotic command. This has been confirmed in the Constitution of the USSR, where the defense of the native country is defined as the sacred duty of every USSR citizen. Military service, in the code of the Armed Forces, is an honorary service.

The military oath and military code of the Armed Forces state that a Soviet soldier must be completely devoted to his people, the socialist fatherland, the Soviet government and the Communist Party. Our soldiers possess a high political awareness and personal sense of responsibility for the defense of our country; they are virile, daring, resourceful, careful; they do the service honestly and conscientiously.

The entire system of training and military education of the Soviet soldiers consists in preparation for the courageous and expert defense of the socialist fatherland.

In the years since World War II, the Armed Forces of the country, including the Military Air Force as one of its components, have been charged with an honorary and responsible duty - they carefully guard the peaceful work of the Soviet workers, they keep the borders of the Soviet Union under lock and key. Intensive and persistent training in the Army continues.

The Soviet pilots are progressing in military and political training. They fly successfully under any conditions. Among the soldiers of the Military Air Force are many fighters capable of executing combat assignments under complicated aerial and weather conditions. These are ace pilots, the masters of dog fights, and snipers.

Vladimir Il'ich Lenin stated that Soviet soldiers must continuously increase the fighting potentialities of the Soviet Army, and keep it in permanent combat preparedness. This statement was once more brought up in the Second Session of the Supreme Soviet of the USSR, by the chairman of the Council of Ministers, N.A. Bulganin, who said: "As before, our problem consists in a firm and constant realization of Lenin's statement - to be always alert and guard 'like the apple of the eye', the Armed Forces and defense of our country."

The foreign policy of the Soviet Union is clear and comprehensible. It is the policy of peace and mutual security, the policy of friendly relations with all nations. It expresses the basic interest of our people and answers the intentions and interests of other nations.

At the same time, the aggressive imperialistic forces, headed by the monopolists of the USA, are creating certain political groups and military blocks, and are trying to reestablish German militarism by all possible means, openly instigating a new war against the Soviet Union, the democratic countries, and the Chinese National Republic. Under these conditions, the Communist Party and the Soviet Government follow a righteous and consequent policy of peace, while taking all necessary precautions to provide a reliable security for our Fatherland.

During the postwar period, the Party and Government have accomplished a tremendous task of future protection, the superiority of Soviet weapons over imperialistic weapons. Through the care extended by our Party and Government, our Armed Forces have progressed considerably since the end of World War II. The Soviet Army and Navy are armed with new, modern weapons and combat technique.

Enriched by the combat experience of the Great Patriotic War, the Soviet Armed Forces have progressed in the field of army organization, operative tactics, education, mastering of modern weapons and combat technique. However, the Party requests the soldiers to persist in continued progress in mastership and combat training.

Our Fatherland demands it. It is well known that the imperialists publicly advertise their intention to start a new war, employing atomic and hydrogen weapons to attack our and other democratic countries' vitally important objectives, with the intention of demolishing the main industrial centers, paralyzing transportation, and demoralizing the population. Servants of imperialism openly proclaim it. Therefore, in view of modern uses of war weapons, high-speed aviation and rocket technique, it is no longer sufficient to only keep in readiness and to answer by an attack any attack of the perpetrators of war, but it is necessary to be alert and thus to deprive the aggressor of the advantages of the surprise element.

To accomplish this, it is necessary not only to expand our military knowledge and military science, but also to advance it further.

The military training of the Armed Forces of our country is based on the possibilities offered by Soviet Military Science: to teach soldiers all warfare tactics

and to act under complicated conditions, possibly close to actual combat conditions, by day or night. Commanders of the Soviet Army teach soldiers not an easy victory in combat but the high art of modern warfare methods, commanding victory over a strong and technically equipped enemy.

This problem will be successfully accomplished by the Air Force if all their knowledge and strength are directed toward teaching the flying personnel to act under conditions of complex aerial and weather situations, complicated by clouds and darkness.

Accident-free operation is an important criterion for high combat training of the flying personnel and this is the goal of every Air Force commander.

The Soviet people can trust their defenders - the soldiers of the Soviet Army. Proud of the trust of their people, Soviet soldiers are always ready to defend the peaceful creative work of the Soviet people and the State interests of the Soviet Union.

Under the banner of Leninism, under the direction of the Communist Party, our people move definitely forward to the triumph of Communism.

THE GLORY OF ACHIEVEMENT, THE GRANDEUR OF VICTORY

iv

Col.N.Stefanov

Ten years ago, on 9 May 1945, the roar of 30 salutes of thousands of guns sounded over the capital of our fatherland, Moscow. Powerful echoes of this salute were heard all over the world, proclaiming that the Soviet people, and together with them all progressive mankind, were celebrating a great victory over the treacherous and malicious enemy - German Fascism. This was the day of joy for every one who experienced all the crucial trials of war, tasted the bitterness of temporary failure and the joy of difficult and even more honorable victories. This day was celebrated by all honest men of the world, all who valued peace and happiness. They praised the Soviet people and their glorious Soviet Army for the fact that above defeated Berlin, over the cupola of Reichstag was flying in the spring wind, a banner of victory - the most striking proof of an honorable liberating mission accomplished by Soviet soldiers.

This was not an easy victory for the Soviet people, at the price of tremendous efforts, privations, sacrifices, at the price of blood and life of many of our best sons and daughters, whose memory will always live in the hearts of freedom-loving nations. Soviet soldiers have compelled the Hitler army to unconditional surrender. The heroes of the front and rear areas, inspired by the honorable ideal of defending the freedom and independence of their Fatherland, and helping the European people to overthrow Hitler's tyranny by establishing one common war camp, in response to the appeal by the Communist Party.

For almost 47 months continued the hand-to-hand fight between the Soviet people and the Fascist hordes. For nearly four years was the fight carried on along the Soviet-German front, where the battles decisive for the outcome of World War II were fought, in which participated four fifth of the world's population, to a certain extent. The Soviet people persistently overcame all difficulties of the war, and leaning on the power of our Soviet state and the great advantages of the socialist system, solved the difficulties for their own benefit.

The Communist Party of the Soviet Union was the inspirator and organizer of the international fight against the German Fascist aggressors. In the shortest period of time and under difficult conditions it rebuilt the entire economics for the benefit of warfare and mobilized the entire working population for the purpose of victory. The Party explained to the soldiers the purpose and goals of the war, consolidated their fighting spirit and discipline, developed fearlessness, virility, and hostility to the enemy.

The second World War did not begin by accident. The plans of attack on the USSR were prepared long before World War II, not only in Berlin, but also in Washington and London. American billionaires had nurtured and armed Hitler's cutthroats. Reactionary circles of the USA, England, and several other capitalist countries, diligently directed Hitler's aggression toward the East, against the only socialist state of the world. Imperialists considered Fascist Germany a power capable to inflict the death blow on the Soviet Union and to demolish the revolutionary and democratic movement in Europe.

Treacherously, without any declaration of war, Fascist Germany attacked the Soviet Union on 22 June 1941. Hitler's Army at this time was completely mobilized and staffed with professional soldiers, with two-year experience in modern warfare. The Fascists had superior arms and combat technique. The factories of occupied Europe supplied them with tanks, guns, arms transport, and airplanes.

In particular, in European occupied countries, besides the factories in Germany proper, nearly 100 aircraft factories and 40 aircraft-engine plants worked for the

needs of Fascist aviation. This permitted the Fascist command to have, in the first phase of the war, a considerable advantage in technique.

The Soviet Army, receiving a treacherous and sudden blow from the superior forces of the enemy, was compelled to retreat while continuing defensive fighting. The enemy tried to penetrate the back areas of the country employing the much talked about "Blitz" war plan. However, the Soviet Army, becoming stronger while fighting, inflicted blows of increasing power one after another.

The Communist Party and the Soviet government inspired their people in the sacred, self-denying fight against the foreign intruders. The Soviet people understood that this was a matter of life or death for the only socialist state in the world and that upon it depended the freedom or slavery of our people. The entire population, terrible in their anger and unappeasable in fight, had risen to the defense of their fatherland.

The Soviet people in the rear areas and on the front collected all their forces for the victory. "All out for the front, all out for victory" - under this fighting slogan, thousands of Soviet citizens toiled in factories and workshops, mines and collective farms. Every month our rear front areas became better organized, keeping the army well supplied with manpower and the fighters well supplied with all necessities for carrying on the war against the enemy.

Lenin's foresighted prediction, back in 1919, came true: "Never will be conquered the people whose workmen and peasants have understood that they are defending their own Soviet state - the government of the proletariat, that they are defending the institution which will secure for them and their children the possibility of a cultural life, and all achievements of human culture". The entire Soviet population came to the defense of its possessions, exhibiting true heroism in work and unbelievable courage, daring, and skill in combat.

The absolute victory was not easy to attain.

In the fall of 1941, numerous Fascist armies advanced to the outskirts of Moscow. Here, in the snow-covered woods and fields of the outlying Moscow area,

they experienced their first sizeable defeat which exploded the myth created by the Fascists as to the invincibility of the German Army. Soviet soldiers fought a strong and cunning enemy without fear. A total of 1390 Fascist buzzards, carrying the black cross insignia on their fuselage, were downed by our glorious air guards - fighter pilots and antiaircraft guns.

During this historic battle of Moscow, Soviet soldiers displayed courage and military skill. In the war chronicles are written with golden letters the names of 28 heroes - Panfilovtsev, daring guerilla Zoi Kosmodem'yanskiy, skilled pilot-fighter Viktor Talalikhin, who was the first in the world to perform a night ram.

Having been beaten at Podmoskov'ye, the Fascist government still continued their bold plans. In summer of 1942, it tried again to solve the strategic problem of Moscow occupation by means of a flank attack from the south. Benefiting from the absence of a second front in Europe, Hitler's Command transferred tens of divisions from the western part of the front and moved them to the east section for the Stalingrad aggression. At the price of heavy losses, the Fascists broke through to the Volga and entered Stalingrad. The significance attached to the Stalingrad occupation is indicated by the fact that one half of the Air Force was transferred to this front sector.

As a result of this gigantic battle, unique in the entire history of warfare, the Hitlerites were again defeated. Their 330,000 men Army found itself in a "kettle" and was annihilated. Our Stalingrad Victory was the beginning of Hitler's decline. As a result, this brilliant victory was followed later by our winter offensive which was opened along the tremendous front line, from Leningrad to the Caucasus.

Then 1943 arrived. The reactionary circles of the USA and England continued to be undecided about opening a Second Front. They followed long-range tactics: to let the Soviet Union bleed, becoming weak in the fight against Hitler's invaders and to benefit by showing themselves as the world's possessors.

In the spring of 1943, intensive fighting started at Kuban. The enemy intro-

duced into the combat about 2000 airplanes trying to widen the existing important base of operations. However, the losses suffered by the enemy in the air battles were high.

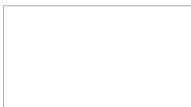
The Fascist Command, feeling safe in the strength of their Western positions, decided to undertake a new offensive on the Soviet-German front in the Kursk region, counting on reestablishing the lost prestige and on recapturing the abandoned Eastern territories. To this area were transferred new weapons of Fascist technology: sixty-ton tanks "Tiger" and "Panther", self-propelled guns "Ferdinand", airplanes "Focke-Wulf". The Soviet soldiers stoically repulsed the modernly equipped enemy, annihilated its forces, and later, changing to a counterattack, advanced to the Dnepr.

Here, within a short time, the "Eastern Fortification", widely proclaimed by the fascist propagandists, crumbled. The Soviet armies, after the Kursk battle, brought Germany to defeat. The year 1943 was the year of basic changes in the course of the Great Patriotic War. During this year about two third of the Russian land, temporarily occupied by the enemy was freed and the Hitler army suffered irreplaceable losses. For example, during this year the Fascist Air Force alone lost more than 14,000 airplanes.

The year 1944 is recorded in history as the year of great Soviet victories. The enemy suffered 10 successive blows resulting in the retreat of the German-Fascist occupation forces beyond our borders and in the transfer of war actions to the territory of Hitler's Germany.

After our native country was liberated from the foreign occupation, soldiers of the Soviet Army helped the people of Poland, Czechoslovakia, Rumania, Hungary, Bulgaria, Albania, and other nations of Europe to break the chains of fascist slavery and to enter the sunny road of freedom and national independence. By accomplishing the mopping-up operations, the Armed Forces of the democratic States contributed to the common enterprise of the triumph over Fascism.

The reactionary circles of the USA and England realized that the USSR was



capable of defeating Fascist Germany all by itself. They knew that their game of opening the Second Front had come to an end, and in the summer of 1944 they started the invasion in northern France. However, the German Fascist Command continued to keep the greater part of the army on the Eastern front, for matters of principle.

The days of Hitler's Germany were over. Soviet soldiers were advancing on Berlin with giant steps. The Soviet Army inflicted destructive blows on the enemy, powerful in scope and ingenious in idea, disrupting numerous defense lines and destroying knots of resistance. In April 1945, the assault on Berlin began. Up to the time of this historic event, the Soviet soldiers were forged in combat, powerful in first-rate weapons, strong in morale and combat attitude. The fight for the last stronghold of Hitler's army, for the capital of Germany, was extremely severe. It is sufficient to mention that in the assault on Berlin, 8400 airplanes participated on our side. Glorious Soviet pilots made destructive bombing runs and delivered offensive blows, demolishing Fascist airplanes on the ground and in the air.

Intensive ground and air fighting resulted in the occupation of Berlin and in the unconditional surrender of the Fascist High Command.

Several months later, the Soviet Army attacked imperialistic Japan in the East and destroyed Kwantung Army, the principal offensive power of Japanese militarism.

The roar of the firing of guns of the Second World War had ceased.

The Fatherland highly appreciated the deeds of the true defenders. For heroism and courage, shown during the war years, thousands of Soviet soldiers were honored by government citations. More than 11,000 soldiers were given the status of "Hero of the Soviet Union" and among them were more than 2000 members of the Air Force. A total of 63 pilots became "Hero of the Soviet Union" twice. Two famous fighter pilots, A.I. Pokryshkin and I.N. Kozhedub have three Gold Stars each.

Stalin, in summing up the war accomplishments, said:

"Great sacrifices made by us in the name of freedom and independence of our country, innumerable sufferings and privations experienced by our people during the war, hard work in the rear and at the front offered at the altar of our country,

were not spent in vain but crowned the complete victory over the enemy".

Futile are the attempts of hireling American, British, and other chroniclers who are trying to lessen the contribution of the Soviet Armed Forces in this war. All peaceful nations know how great is the significance of this historic event. The main result of the victorious war was the destruction of Fascist Germany by the forces made available by the Soviet socialist government. The imperialistic plans for demolishing the world's first socialist country by using the power of Hitler's invaders came to naught. The Second World War introduced a new distribution of the political forces in the world arena. A powerful camp of peace and democracy, with the USSR and Red China at the head was organized. One third of the world population entered the road of socialist reconstruction. This truly remarkable success became possible through the victory over German Fascism in the last war.

On their own shoulders, the Soviet people have carried the entire strain of the war against Hitler's Germany. They made colossal sacrifices in the name of freedom and national independence. Hundreds of thousands of Soviet people gave their lives on the battle grounds. And is it possible to forget the damage done by the Hitler's occupation to the national economy of our country? The Soviet people have a good memory. They remember that the Nazi occupation forces destroyed and burned 1710 Soviet cities, more than 70,000 villages, depriving 25 million people of a home. Ruins of Stalingrad, Kiev, Sevastopol, Vinsk, Odessa, Smolensk, Voronezh, and many others - can that possibly be forgotten?

The Soviet people have celebrated their happy day of victory ten times so far. For the past ten years, the workers, while recovering from their war-wounds, have progressed in all fields of economics and cultural life. Our heavy industry, being the basis of the whole economic structure, is progressing successfully. Agricultural workers are fulfilling the program of grain production established by the Communist Party, in the amount of 10 billion poods (36 lbs). The output of light industry products grows year after year. Great success was achieved by the workers in the arts and sciences. The welfare of our people is infallibly increasing.

The Soviet Union tirelessly strengthens their ties of friendship and cooperation with the countries of national democracy. It renders brotherly assistance to the great Chinese people. Through this help, the workers of the democratic countries also become victorious in the field of peaceful socialist advancement.

Our successes are tremendous. The Soviet people fully understand that they owe all these achievements to their own Communist Party, which pointed out the road to victory in war and in the years of peaceful socialist reconstruction. The unity of the Party, government, and Soviet people is the source of the power of our system.

The Soviet people are occupied with peaceful, creative work. They threaten nobody. Our foreign policy is based on the principle of peaceful coexistence of countries, notwithstanding their social and political system. Expressing the basic interest of the people, the Communist Party and the Soviet people steadily and persistently pursue a policy of war prevention.

However, the peaceful policy of the Soviet Union is opposed by an aggressive foreign policy of the USA, which could be expressed as a policy of "position of force". Reactionary forces in the USA cannot forgive that only ten years ago their calculations on exhausting and weakening the Soviet Union were destroyed and that the socialist state came out of the war stronger and tougher, and more potential in the world system. The stronger the democratic camp, with the Soviet Union at its head becomes, the stronger will be the wrath of enemies from the imperialistic camp.

Ever conscious of the real danger of imperialistic attacks, our Party and Government consider that one of the most important future problems is the stabilization of the defense power of the socialist state, maintaining the fighting strength of the Soviet Army at a level which will secure our safety. In his order of 23 February 1955, the Minister of Defense of the USSR, Marshal Zhukov, states:

"Fighters of the Soviet Army and Air Force, who closely surround the Communist Party and the Soviet government must be always ready for an honorable defense of our beloved country".

Therefore, Soviet pilots are facing a large and responsible task. They must

continuously improve their combat skill and be in constant readiness to resist any aggressor. It is necessary to master all forms and methods of tactical warfare, creatively develop and advance Soviet military science, develop new tactical methods for use of different types of aircraft in battles with a strong, treacherous, and technically well-equipped enemy. Training maneuvers must be adapted as closely as possible to the conditions of actual warfare.

The technical level of our aviation is considerably higher than it was during the war. Our aviation now has modern jet aircraft, equipped with precision instruments for use in high-speed flying under any weather conditions, during day or night, and at high altitudes. It is a matter of honor to master these complicated techniques.

The Soviet people love their own child - military aviation. It calls their pilots proud hawks, and glorifies their deeds. When the press sometimes carries a brief report of attempts by American airplanes to enter our air space, attempts that usually end with the defeat of the uninvited, bad-mannered guests, then the Soviet people are sincerely grateful to the peaceful workers of the socialist country, their real guards, who carefully watch our borders.

The Soviet peoples can toil in peace; their possessions are effectively guarded by our Armed Forces, so many times victorious.

SOVIET AVIATION IN THE GREAT PATRIOTIC WAR

by

Lt.General P.Bravko

In May, it will be ten years since the end of the Great Patriotic War, fought by the Soviet people against Fascist Germany and her satellites. Our Armed Forces, created under the auspices of our people and the Communist Party, defended honorably the freedom and independence of our Fatherland.

It is known that the Hitler High Command depended mostly on the surprise element, and many times when an attack was made on a weak and militarily unprepared nation, their tactics would be fully justified.

Thus, in September of 1939, the sudden attack of Hitler's Germany on peasant Poland resulted in the destruction of the latter. In April of 1940, the Fascist armies accomplished the sudden occupation of Denmark and Norway, in May they attacked Holland, Belgium and Luxembourg. Starting the war with air raids on airports, railroad centers, and other important objectives, and also by landing airborne forces in the rear areas and by organizing mass invasions simultaneously, the German Fascist army advanced to the border and occupied France.

In the war with the Soviet Union, the Hitlerites counted on accomplishing results similar to those obtained in the war against the European countries by means of the "surprise element". Treacherously attacking the Soviet Union, the German Fascists expected to destroy the Soviet Army and to enslave our people within a few weeks.

A total of 170 enemy divisions, fully mobilized and armed with modern weapons, a considerable part of which were tank and mechanized units, were brought into the fight against the Soviet Army. From the air, the Fascist armies were supported by fleets of thousands of airplanes.

As a result of the sudden aggression of the powerful forces of Fascist Germany, mobilized and trained in advance, and the resultant unfavorable situation for the Soviet Union, we were compelled to retreat, leaving to the invading army vitally important and the richest regions of our country.

I.V. Stalin, in analyzing the situation of this period, said that in 1941-1942 we had moments of desperate situations, "when our army was compelled to retreat, leaving home towns and villages... because this was our only choice".

The Soviet Air Force, during this phase of the war, was fighting exceptionally intense and heavy battles with the superior-in-number enemy.

The situation in 1941 was complicated for us by the fact that the rearmament of our army with new airplanes had not been completed. Besides, the Hitler Air Force, up to the moment of attack had more than two years experience in modern warfare. Because of all these circumstances, air superiority in the first months of the war, was on the Fascist side.

Much effort was required of our aircraft industry and the Soviet pilots to secure air superiority. As is well known, this problem was completely solved only after the air battle in Kuban' and in the Kursk arc, in 1943.

During the first period of the war, the main effort of our aviation was centered on the support of our ground forces, on covering them from air attacks, on the defense of the rear area and objectives of enemy attacks. Giving continuous battle, the Soviet pilots were reducing the enemy's power and killing its best trained personnel.

In this serious situation, the Soviet Army was powerful enough to stop the enemy advance and later to annihilate it. This proved the tremendous vital ability of the social and state organization of the USSR.

The Communist Party and the Soviet government urged all our people to participate in the defeat of the enemy. The Soviet people, brought up and led by the Communist Party, inspired by the honorable and righteous goals of the fight, undertook exploits unheard of in the course of history, and destroyed a strong, technically well-equipped, and powerful enemy. All efforts of the Soviet people, the Communist Party, and the Armed Forces were directed at that time toward the disruption of the plans of the Fascist invaders for a "Blitz war" and toward creating the turning point of the war.

In the fall of 1941-1942, the German army, massed on the outskirts of Moscow, was inflicted a decisive blow. On the fields of the outlying Moscow area, the Soviet Army dispersed the myth of the invincibility of the German Army. The German plans for a "Blitz" failed. The Soviet pilots, at the time of the heroic Moscow defense, successfully solved the problem of protecting the capital from enemy attacks. At the beginning of our counterattack, the Soviet command had succeeded in concentrating considerable forces and in achieving air supremacy in the Greater Moscow area, forcing the enemy air forces to retreat. This proved of considerable help to the ground forces.

The Stalingrad battle was the decisive moment of the air battles. It is known that in the summer of 1942, the Hitler Command, benefiting from the absence of a Second Front in Europe, had collected all possible resources and used them in the offensive toward our front.

In the beginning of the Stalingrad offensive, the German Air Force still had an advantage in the air. Soviet pilots were compelled to fight under exceptionally complicated conditions. The enemy was superior in number and introduced into the fight its best resources. Not having enough forces for an all-out offensive along the entire German-Soviet front, the enemy had concentrated its main power in a comparatively narrow area. The situation existing in this region can be characterized by a saturation of a fairly small sector of the front with a large number of airplanes.

Continuous intensive air fights were in progress. Soon, in the fight for air supremacy, a turning point favorable for us could be perceived. This was brought about by a series of factors: equipment of our Air Force with a multitude of new, better constructed airplanes by A.S.Yakovlev and S.A.Lavochkin, better management and guiding of the air fights, and also combat experience gained by our pilots during a period of more than a year of constant, intensive fighting.

The action of our Air Force exhibited a more and more aggressive character. The efficiency of military aviation was considerably increased by the use of new airplanes, permitting extensive use of vertical maneuver and new combat techniques. At Stalingrad, new methods of airplane guiding by radio directly from the battle field, were being used.

To the moment when a counterattack at Stalingrad was started by our armies, our Air Force in this region outnumbered the German airplanes. A successful air blockade of the surrounded enemy armies at Stalingrad was the real indicator of our increased power. As a result of it, the 330,000 member Fascist army was surrounded and deprived of any air support.

The attempts of the German Fascist Air Force High Command to take revenge for the air defeat suffered at Stalingrad, during the battles at Kuban (above the Taman Peninsula) in the spring of 1943 ended in failure. Two powerful air forces, approximately equal in number were fighting at Kuban. The Kuban battle continued for more than two months and was concluded with the victory of our Air Force. Our fighter aircraft achieved air superiority and secured freedom of action for the ground forces and also for low-level fighters and bombers. At Kuban, the air battles were usually fought over the territory occupied by the enemy. Here, new deployment of the altitude combat formation of fighter planes was used. The high skill of our glorious pilots who demonstrated the high art of aerial warfare, was forcefully demonstrated.

The air victory at Kuban shows the superiority of our flying personnel, airplanes, and tactics over those of the enemy. After the Kuban battle and to the last

days of the war, the air superiority continuously maintained and permanently defended by our Air Force was what benefited our ground forces.

It is of interest that at Kursk in 1943, the enemy, while deciding to annihilate our ground and air forces during the first days of the offensive, acquired air supremacy only over a very limited region but was unable to hold this position. Soviet pilots regained air supremacy within a few days and destroyed the best group of Fascist aircraft.

On the ground, the experience gained in the Kursk battle made it possible to retain the superiority gained in the air; when starting a new operation, it is necessary to start a decisive counter-offensive against the attacking formations of the enemy.

During 1944, the Soviet Army, as generally known, inflicted on the enemy ten destructive blows. In this year, the Soviet Army expanded its offensive over a large territory, deprived the Fascist Command of the possibility of maneuvering its reserves, and caused complete destruction of a large strategic unit of the enemy.

In every one of these ten attacks, a multitude of latest combat aircraft participated. Use was made of our air commanders' high skill and ability of maneuvering large forces swiftly. Another factor was tactical plans carefully and secretly prepared by the Air Force and usually not expected by the enemy. The network of interconnected air bases and material resources was laid out long before, and shortly before the operation, powerful forces were secretly concentrated opposite the enemy and introduced into the fight.

The attacks by our aviation, as a rule, were carried out in close cooperation with the ground forces. Exactly at the right time, several groups of airplanes would appear over the battle field and expertly disrupt the distributions of the enemy forces, which were handicapping the offensive of the ground forces.

Perfectly developed tactical control of the air forces above the field of battle permitted support of the ground forces under widely varying conditions. Airplanes, ordered from the airfields by radio, reached the battlefields and supported

the ground forces in an exceptionally short time. The use of radar allowed the interception of aircraft and their destruction before the bombing was started.

All this contributed to the success of the combat actions of the ground force and increased the speed of their offensive.

The conclusion of the offensive operation of the Soviet Army which led to the complete destruction and capitulation of the German Fascist armies, occurred at a time of complete and indisputable air superiority of our forces. However, even in the conclusive stages of the Great Patriotic War, the Soviet Air Force fought intensive air battles. The enemy knew that it was losing the war in the air and on the ground, but it did not give up. All forces of the Fascist Air Force were removed from the other areas and concentrated at Berlin. The Hitlerites did not leave many airplanes to fight against the Anglo-American armies. All possible forces were used to fight the Soviet Army. This, by the way, allowed the Anglo-American aviation the unpunished bombing of factories and workshops in Czechoslovakia, Austria, and other countries during the last days of the war.

During the Berlin battle, many intense fights occurred on the ground and in the air. To support the ground forces, our command introduced into the fight in this area more than 8000 airplanes. The enemy was completely annihilated by the mutual efforts of the Army and Air Force. The Hitlerites were compelled to capitulate.

The Soviet Army honorably discharged its duty toward the Fatherland. The heroic air forces of the USSR, supported by all the people, defended the freedom and independence of their native country and liberated the other countries from the Fascist yoke. The Soviet Aviation, by demolishing the air forces of Hitler Germany, secured for our ground forces freedom of action and freed the population from the danger of air raids. Its powerful blows directed at the armies and military objectives of the enemy contributed to the swift offensive of our armies.

Our remarkable Air Force personnel improved and became stronger during the years of the war. Savitskiy, Folbin, Ryasanov, Kozheduk, and others proved themselves skillful Air Force commanders. They and tens of other commanders, training

officers like they, had trained hundreds of fearless and skillful pilots, completely devoted to their Fatherland, masters of air fights and bombing and strafing attacks, such as Gastello and Talalikhin, Borovykh, Sukhov, Katrich, and Safonov and many, many others. In the most difficult moments of dog fights, they acted expertly, with the courage, cleverness, and initiative inherent to the Soviet people, and were victorious.

The victories of the Soviet Army were possible through the heroic work of the entire Soviet people, who furnished the army with all requisites. It is known, e.g., that our aircraft industry produced nearly 40,000 airplanes per year during the last three years of the war, which made possible the replacement of the war losses and created large resources.

All this was possible only through a successful realization of the program of socialistic industrialization of our land and the over-all development of the heavy industry established by the Communist Party.

. . .

The creation of a world camp of socialism and democracy against the existing world camp of capitalism was the most important result of World War II. This was possible because of the fact that the defeat of Fascism weakened the position of the world capital and gave an exceptional lift to the democratic movement. The Soviet people and their heroic army played the decisive role in the development of these international events.

This situation was not received favorably by the imperialistic governments. They would like to see capitalism re-established not only in the countries of national democracy, but also in the USSR; this finds its expression in the aggressive foreign policy conducted by the ruling class of the USA, England, and other capitalistic countries.

Having made the decision of starting a new World War, the imperialists of the USA and their satellites are organizing various military blocks, work in the direction of re-establishing German militarism, conduct a race for armament, create nu-

merous military bases surrounding the peace-loving countries, and conduct an unethical war propaganda. The meeting of the North Atlantic Treaty Organization, held at the end of last year, accepted a resolution for the preparation for atomic war.

A special place in the aggressive plans of the North-Atlantic block is given to aviation. American imperialists in their aggressive attempts directed against the countries of the socialist camp, consider air force and atomic weapons of great significance. Almost two third of large-scale materiel allotments are intended for the military air forces in USA. Military leaders of the USA and England publicly state that they expect to start a new war with a surprise attack from the air, using atomic and hydrogen weapons against vitally important objectives of our rear areas, counting on destroying the main industrial objectives, paralyze our transport and demoralize the population in the course of several days. The aggressors intend to take the initiative in the war by utilizing the destructive power of atomic and hydrogen weapons.

As before, the surprise element is emphasized. Of course, under modern conditions of weapons of great destructive power, progressive high-speed aviation and jet technique, the factor of surprise will have an even greater significance than before, unless measures for demonstrating its influence on the results of the conflict are taken.

The duty of the Soviet soldier consists in preventing a realization of the factor of surprise and of being always on the alert. We have to be ready to disrupt the malicious plans of the war perpetrators at the moment that this plan begins to go into effect.

Preparedness is the most important prerequisite in solving this problem. Soviet pilots must persistently develop their tactical knowledge and study the Soviet military aviation science. We are obliged, however, not only to study military science but also to advance our technical aviation ideas. Taking into account the existing development of aviation technology and the nature of modern warfare, we have to develop more efficient use of combat methods in aviation. Our military

aviation, together with other branches of the Armed Forces, is capable of solving successfully various tactical problems of complex modern warfare.

After the war, the Communist Party and the Soviet government promoted the further progress of our Armed Forces. On the basis of efficient development and a rapidly growing heavy industry, our people strive for more achievements, fully meeting the requirements of modern aviation technique.

Through the persistent care of the Party and the government, our military Air Force is equipped with the latest devices of modern aviation technique, in sufficient quantities. The air personnel have mastered this technique. However, this is not sufficient. Aircraft technology is progressing and developing at an especially fast rate. The air arm of the Armed Forces is outfitted with highly efficient airplanes, instruments, and other equipment. The mastering this technique to perfection is our principal problem.

The power of Soviet aviation lies not only in its technical equipment. Our Air Force is famous for its personnel. Soviet pilots, navigators, technicians, fighters are toiling devotedly through the days of peaceful military training. Air commanders who are trusted by the Party and government, must teach their subordinates initiative, insistence in accomplishing practical missions, and the will to overcome difficulties. Courage, fearless fighting, fitness to overcome the difficulties and an ever-readiness to fight the enemy to the victorious end, not sparing their own effort and life - these characteristics must be constantly cultivated in the pilots by commanders and political educators.

The Soviet Union, the People's Republic of China, and all nations of the socialist and democratic camp are constant defenders of peace and insist on easing the world tension. Peace-loving nations keep careful track of the intentions of the aggressive circles of capitalist countries. However, any attempt of the imperialist beasts to inflict a surprise attack on the countries of the peaceful camp is doomed to failure.

TACTICS

SEARCH FOR AN AERIAL TARGET

by

Three-time Hero of the USSR Air Force, Guard Major General

A. Pokryshkin

In April 1945, a group of six Soviet fighter aircraft, headed by K.V. Sukhov (now Hero of the USSR) was escorting our ground forces in the region of the river Spree. Spotting three groups of enemy airplanes in the air, the Soviet fighters attacked them, shot down nine airplanes, and thus dispersed the blow directed toward our ground forces. The Soviet fighters did not lose a single plane.

What was the reason for the success of our fighters in this battle?

To answer this question, we have to analyze the action of officer Sukhov's group more carefully. On that day, when our air forces were assigned to give air support to our armies, it was known that enemy aircraft had been operating in groups of 10-30 airplanes since morning, at 20-30 min intervals, at an altitude of 2500-3000 m. The enemy intended to interfere with the advance of our ground troops by means of air raids.

The Sukhov group entered the patrol region, deploying at an altitude of 4000-5000 m. There were no clouds and the visibility was excellent; but farther down, at an altitude of 1500 m, the visibility was poor because of smoke. The search maneuver, in the patrol zone, was directed from north-west to south-east. The front of the search group was constantly facing the most probable direction of the enemy attack and the sun was in the south-east. The maneuver was executed by deploying

the group along the edges of the rectilinear area toward the sun, following the "all-out" method. If the airplanes were following a north-western course, the turn would be made on the command of "Turn 180° Left", and if they were following a south-eastern course, then the command would be reversed. The established intervals between the airplanes in pairs permitted execution of this maneuver.

After the turn was made, the entire group, keeping the required intervals, was flying in staggered formation (the lowest pair at 3000 m and the uppermost pair not lower than 4000 m), and all scouted the patrolled area at boosted speed. This created favorable conditions for searching the entire escort area and, in addition, saved fuel. At the end of the run, the fighters, using the speed boost (at the same engine rpm), were easily able to regain their previous speed.

This was how the search of the fighters was organized during the patrol. Obviously, all means - the front of the group being directed toward the enemy, the deployment toward the sun, the high speed of action, the open combat formation, and the patrolling at altitudes inaccessible to the enemy - literally everything was directed toward annihilation, counteracting a possible surprise appearance of the enemy, and toward its detection at a considerable distance.

Thus, it was no accident that the enemy airplanes (three groups of six Focke-Wulf - 190 each, covered by five Me-109) were discovered by our fighter air craft 15 km from the front line, at the lower left front, at an altitude of 3000 m.

We will not describe the details of this flight, and will mention only that, during the entire fight, the Soviet airplanes continued the search and carefully tracked the changes in the air situation. Therefore, they were able to discover in time the approach of a second and third group of enemy airplanes and attack them, retaining the initiative in the fight.

The Sukhov group won the battle. It acted daringly, skillfully, and precisely. What were the results of the skillful and artful action of the pilots?

First of all, an excellently organized search. Everything was directed toward making the search active, complementing the offensive action of our fighters at the

7

moment of detection of enemy. The group commander correctly estimated the air situation (altitude, nature of the action of the enemy airplanes, and weather conditions-visibility and sun). The maneuver of the fighters was skillfully arranged, permitting a continuous search to be carried on in the most dangerous direction of attack and guarding against sudden attacks of the enemy planes from out of the sun. The high flying speed contributed to the success of the search. In carrying out the search, the Soviet fighters had pre-established a favorable situation for the battle. In addition, the search was continued during the fight itself.

What would happen if our pilots had not been well prepared for the search? They would have been unable to discover the enemy at such a distance and might even (which is infinitely worse) have been discovered by the enemy first. In that case, the factor of surprise would have been lost and they would have been forced to accept a fight against a much superior enemy, under very difficult conditions. The outcome of such a fight would be very difficult to foretell.

Thus, it can be said that the success of Sukhov's group was secured primarily by a well-organized active search.

The history of our aviation is full of similar examples. The chronicle of the Great Patriotic War contains many heroic exploits of the Soviet pilots. Limitlessly devoted to the Communist Party and to their great native country and assured of the righteousness of their ideals, filled with burning hostility toward the enemy, they would enter the fight against a superior enemy courageously, and were usually victorious. That was the result of the tremendous ideological-political superiority of our military Air Force over the Air Force of the enemy. However, this is not the only reason for the success of our pilots. Aerial battles are complicated. A mere desire to win is not sufficient for victory. It is also necessary to possess fighting skill, the most vital condition for victory. Exactly this kind of fighting, not by sheer superiority in number but by skill, characterizes the actions of the Sukhov group.

There is a common saying among fighter pilots: "Who sees first, wins". This, in short, expresses the meaning of an active search. The ability to organize a search properly and, specifically, to make it active, has a tremendous value in the combat activities of fighters.

At present, our fighter pilots are flying jet aircraft which differ considerably from airplanes with piston-type engines. Their speed is two times the speed of airplanes used during the Great Patriotic War; their rate of climb is also very much higher. They have more powerful armament and are equipped with perfect search instruments. These factors result in changes in the method of search; however, the significance of such search patrols is not lowered but rather increased.

Search patrol cannot be defined as air alert. The air alert method consists in checking our own airplanes within the group with the intention of maintaining the correct place in combat formation, prevention of losing them from sight, and prevention of collisions. Search patrol is defined as the action of the pilot during the mission (reconnaissance of the air space and maneuver) for the purpose of locating enemy aircraft. The search patrol method differs from the air alert method by the type of action. A fighter pilot, used for air searching, should first of all be rated by his ability to carry on an active search for an aerial target.

How does the activity of the search proceed in a modern jet aircraft? The search is accomplished by continuous observation in all directions and over considerable distances, by high-speed flying, and by the correct use of air and weather conditions.

The continuous searching is necessary because of the possibility of a surprise appearance of enemy aircraft at any stage of a combat mission and also to prevent detection of airfields where the take-offs and landings are made. This means that a fighter must start the search for the aerial enemy from the moment of take-off and carry it unremittingly through in all directions until the end of the flight.

In the course of the flight, persistent search in all directions is necessary for locating new enemy forces advancing along the front. It will permit corrections

to be made in the strategic plans and to prevent sudden attacks.

The continuous search patrol method in all directions should not be understood to mean that all pilots must cover the entire territory at all times. Depending on air and weather factors and the character of the mission, the attention of the pilots is centered on the more important sectors, in the direction in which reconnaissance is more difficult or where the appearance of enemy planes seems possible. In group flights, the sectors of the search are divided among the subdivisions and individual pilots; every combat formation is assigned to a special sector.

Open flight formations best meet the requirements of active search. Pilots flying under such orders can pay more attention to the search itself. Proper placement of airplanes in a group of an open formation creates conditions favorable for a thorough observation of the air space, especially in the rear hemisphere. Besides, large intervals and distances between the airplanes and groups deployed by altitude, increases the covered air space. This is clearly demonstrated in Fig.1.

It has been proved by actual war experience that the success of an aerial fight depends greatly on the detection of enemy airplanes at great distances. In our example, Officer Sukhov, who discovered the enemy planes at a distance of 15 km, promptly evaluated the situation, made his decision, and indicated the plan of action. If the Fascist aircraft had been discovered at a shorter distance, say 5-6 km, then the fight would not have been so successful.

The lead in locating the enemy gives the fighters a tactical advantage and some additional time for organization of the fight, and creates the conditions for surprise action. The one who discovers the enemy first has a better chance for a better tactical position. The search must be long-range to be efficient.

Under present-day conditions, with the Air Force equipped with high-speed jet aircraft, the skill of the pilot to conduct a long-distance search from his own airplane acquires an even greater importance.

The increase in speed resulted in a decrease in the time available for closing-in head-on attacks. However, the time of overtaking and the time of closing-in on

the tail also decreases. This can be explained by the fact that the difference in maximum speeds of jet aircraft, e.g., fighters and bombers did not increase in comparison with the difference in speeds of airplanes of the war period.

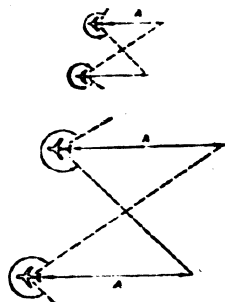


Fig. 1 - Increase in Patrol Area with Increase in Intervals and Distances

From this it follows that,

from the aspect of a surprise enemy attack, for modern airplanes flying at a speed close to maximum, the front hemisphere is more dangerous than the rear one. This means that the search in a jet aircraft must be accomplished at high speeds and the observations must be so organized that maximum attention is directed on the front hemisphere.

A high-speed flight allows fighter pilots to pay more attention to the search ahead of them and less to that in the rear hemisphere, and this is one of the

typical aspects of active search. However, what forces the pilot to pay attention to the rear hemisphere is the danger of being attacked suddenly from the tail. The use of open combat formation and high-speed flight (close to the maximum) minimizes the danger of a sudden attack on the jet fighter from the rear and permits the pilot to pay maximum attention to the front hemisphere. Flying at high speeds increases the time required by the enemy for gaining a tail position within firing range. Therefore, it will be detected in time, which will secure escape from its attack and occupation of a favorable position for the fight.

Let us explain this on an example. Assume that the enemy airplane, which is being attacked from the rear, travels at a speed equal to 940 km/hr and that the

speed of our airplane is 500 km/hr in the first case. Then, the speed of approach will be 122 m/sec. In the second case, the speed of our airplanes is assumed to be 900 km/hr and the speed of approach to be 11 m/sec. The relative patrol distance in the rear of the airplane tails (A) will be equal to the interval between the airplanes (e.g., 800 m) multiplied by the tangent of the angle formed between the direction of sight of the pilot who was assigned the observation of the tail section of a certain airplane and the maximum turn of his head perpendicular to the longitudinal axis of the aircraft.

$$A = 800 \tan 60^\circ = 800 \times 1.7 = 1360 \text{ m}$$

The escape of the enemy, at a firing range of 600 m, will be accomplished, in the first case, in

$$1360 - 600 = 760 \text{ m}; \frac{760}{122} = 6.2 \text{ sec}$$

and, in the second case, in

$$\frac{760}{11} = 69 \text{ sec}$$

The second case demonstrating the high-speed flight of our fighters is different. The enemy, having considerable speed superiority, will be approaching as long as the firing range is more than one minute. This means that a pilot, flying at high speed in a jet aircraft, can, after observing the rear hemisphere, concentrate his attention during a considerable length of time on the front hemisphere, making the search more effective.

Correct calculations and proper use of aerial and weather conditions in the search contribute to the success of the search. Under today's conditions, the air situation may be even more complicated and changeable than during the past war. Good knowledge of the air situation and correct evaluation of the occurring changes

(which will be relayed by the control points) will enable the commander of the fighter group assigned to the search to define the optimum direction for the patrol mission. Knowing the situation, from flying patrol during an air alert mission or

from a pursuit mission, the commander will be able to select the most rational altitudes and flight courses.

During the search the meteorological conditions must be considered thoroughly. If the position of the enemy or the direction of the flight is known, the fighters will so select the course that they can attack the enemy from out of the sun (Fig.2a). Primarily, this permits the fighters to be camouflaged by the rays of the sun and secondly, it creates better conditions for locating the enemy. The reflection of the sun rays from the airplane makes it possible to discover them sometimes at a distance of tens of kilometers.

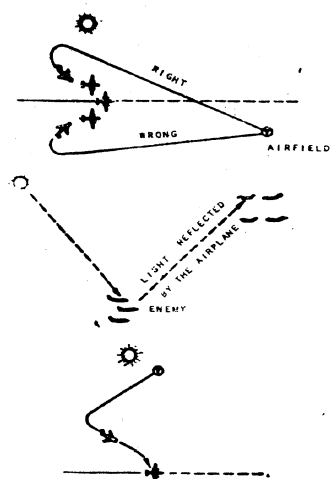


Fig. 2 - Position of Sun during the Search

However, during a search it is not recommended to arrange the flying course in such a way as to have the sun directly behind our own planes, because it makes immediate discovery of the enemy, appearing in the rear hemisphere of our aircraft, more complicated. If the situation requires a flight from the direction of the sun, it is never recommended to fly a straight course; rather, the route should be extended and changed in such a way as to have the sun at the side (see Fig.2c).

In this way, when the sun is at the enemy's side, it is necessary to carry on the search at altitudes considerably exceeding the possible altitudes of the enemy

flight. In such a position, the sun interferes less with the observation, and the airplanes can be detected at a greater distance by the reflected rays (Fig.2b).

To establish the weather conditions during the search, it is important to know

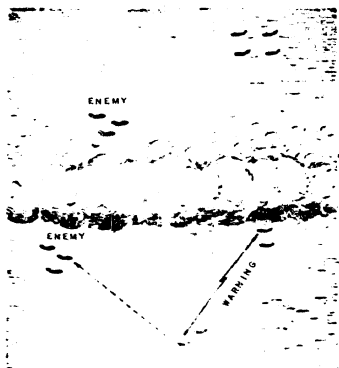


Fig. 3- Search above and below Clouds

the location of the inversion layers of the atmosphere. A flight in the inversion layer reveals the position of the fighters exceptionally well because of the white trails which can be seen clearly from a great distance. Therefore, it is required to fly higher or lower than this layer. Even after the enemy has been discovered by the smoke banners, it is recommended to enter the inversion layer only after the initial positions in the fight are taken, i.e., at the moment of attack. To

avoid accidental entering of the inversion layers, it is necessary to make reconnaissance flights in the zones assigned to fighter action.

A horizontal smoke screen will camouflage the airplanes and reduce the horizontal distance at which detection is possible. However, the airplanes, hidden by the smoke in this direction, can be seen clearly in a vertical direction. Therefore, the search under smoke screen conditions preferably should proceed above or below the enemy position. If the color of the airplane is similar to the color of its surroundings, it can be detected in sunny weather, both from above and below and, in cloudy weather, from below.

In cloudy weather the search has to be adapted to the type of clouds and to the zone of the search: above or below the clouds.

If the search is conducted below the clouds, it is preferable to direct one pair of searchers along the lower ridges of the clouds and the other below the maximum possible altitude of the enemy. The assignment of this pair is to detect the enemy airplanes against the cloud background (Fig.3). The first pair should keep the detected enemy aircraft from entering the clouds. This type of combat organization at the time of search was used with a piston-engine fighter, in which case the deployment of the pair was of no specific significance. Use of jet fighters, however,

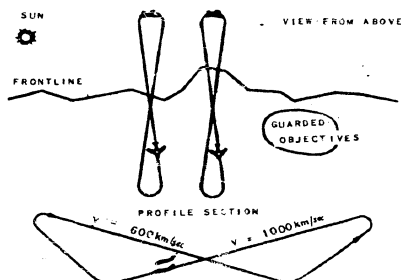


Fig. 4 - Change in Maneuver during Search

which have a climbing advantage over the piston-engine type, relies on greater deployment of the groups. It is known that a combat formation, so deployed at a given altitude as to have the distance between pairs not exceed the altitude at which the deployment was executed. In this case, the lower pair can be of immediate assistance to the upper pair. A pair of jet fighters will climb during the combat to 2000 m. Therefore the deployment of each single pair of jet fighters, during a search below the clouds, can be conducted on the range of maximum visibility.

By conducting the search above the clouds it is not recommended to fly in close

formation but to stay higher than the possible altitude of the enemy aircraft, since they can be detected more easily from above against the cloud background (Fig.3). When the search is conducted under conditions of broken clouds, it is not recommended to fly close to the clouds either from above or below, so as not to reveal one's presence against the background and to avoid a sudden enemy attack through cloud openings.

During the search, the fighters execute a series of maneuvers, which facilitate the detection of the enemy and interfere with its activity. The success of the search activity of the Sukhov group, as we had proved, was achieved to a considerable degree by a well-organized maneuver and by scouting of aerial and weather conditions. The possibility of conducting the search at high speeds, which ensures greater efficiency, also depends on properly executed maneuvers. The order of the search maneuver will vary. In each particular case, the plan has to be arranged in accordance with the tactical situation and the character of enemy action. Many valuable data can be obtained from war experience.

Perhaps it is possible for jet fighters, while patrolling or covering, to carry out a search by executing a maneuver (of course, under corresponding conditions) known as the shuttle type (Fig.4), i.e., the maneuver executed by the Sukhov group.

Of course, this is possible. In our opinion, such maneuvers should be used. It is true that intervals, distances, and speeds will be different from the ones used by the Sukhov group, but the character of the maneuver remains.

In many cases, the jet fighters, for better patrol of the rear hemisphere, can accomplish partial deployment while advancing from one flank to another. However, these deviations from the course may not be worth executing since they lengthen the flight course of the fighters.

The success of the search depends to a certain degree on the system of organizing observations in flight.

The best system of observation for the pilot is the so-called zonal system of observation. In this case, the central beam of the field of view of the center

zone passes through the plane of the longitudinal and lateral axis of the airplane, while the upper zone is located higher at a $45-60^\circ$ angle and the lower zone is located lower at the same angle from the central beam (Fig.5). This method is described in detail in an article written by Guard Major B. Abakumov: (Bibl.1).

While flying in groups, every pilot is assigned a zone of responsibility where he carries on all observations, is fully responsible for the timely discovery of the enemy aircraft and also of the overlapping zone, where he duplicates the observations of the other fliers. To facilitate the action of the pilots during the flight and to concentrate their attention, the zones of search are made to coincide with the directions of observation: The combat order of flight is organized along this system. The pilot of the next aircraft conducts the search in the established directions and simultaneously observes his lead plane and other airplanes of the

flight.

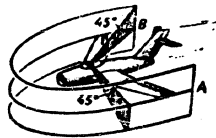


Fig.5- Zone System of Observation

The distribution of responsible zones among the pilots does not exclude the necessity of all-around observation. Each pilot periodically checks the entire zone, but pays special attention to the assigned zone. In this case his course of observation is based on a zone system

also, but the change from one zone to another occurs on the border of the assigned zone.

During the search the group flies in open formation. If the group consists of one flight or more, the combat formation will be deployed at a certain height. Figure 6a shows a combat formation of one pair during the search and also gives the zone of responsibility and the overlapping zones of the leading and other aircraft. As indicated, the leading airplane is responsible for locating the enemy in its own front hemisphere while the rear hemisphere is covered by the airplane next

in line who is responsible for the zone toward the leading aircraft, i.e., the latter's rear hemisphere. It should be mentioned that the zone of responsibility of the leading airplane is always in the direction of a following airplane, to combine the search with observation.

Within the flights, the observation zones are distributed as follows: The commander of the flight conducts the search in the front hemisphere, his leader covers the zone toward the following pair (following at the opposite side) and higher. The leading pair of the flight flies above the following pair, in a combat formation of increased interval, and has a zone of responsibility toward the commander of the flight and extending downward (Fig. 6b and c).

The combat formation of the group of fighters is always so organized as to preserve all-around observation and to create the highest number of zones of responsibility toward the possible point of appearance of the enemy and toward the direction which is difficult to observe (against the sun, haze, camouflaging background of clouds, and ground).

Since during the flight, the following aircraft must carefully watch the maneuvers of the leading airplane, the crew, for convenience of observation, occasionally has a tendency to assume a position, relative to the leading plane, at the side of the sun. In our opinion, this should not be done. Despite the fact that it is difficult to carry on observations against the sun and precisely for this reason, the combat formation must be arranged in such a way that the search in this direction is carried on by a great number of observers. An attempt to reduce the blinding effect of the solar rays could be made by altitude deployment of the combat formation of the group.

As soon as enemy is detected in the process of the search, the entire group must be immediately notified. Intercommunication takes place by radio. Signaling by airplane maneuvers (during a flight in open formation) is used only when the radio fails or when it cannot be used for any reason.

Such details as the system of data transmission are important. The best prac-

tical method is the timing method of intercommunication in the air (Fig.7). The azimuth of the located airplanes is given by the conventional watch dial azimuth scale, divided into 12 directions. Relative upward or downward deviations are in degrees. Figure 7 shows sample reports made by a pilot who has located an air enemy.

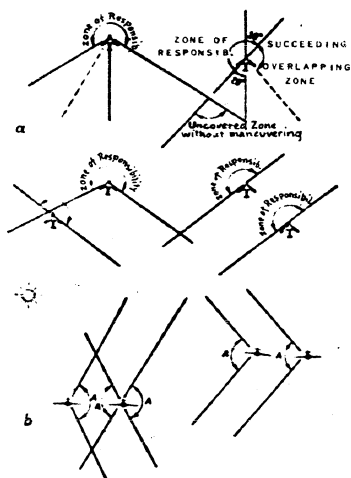


Fig. 6 - Combat Formation for a Pair and Flight Pattern During Search

the high speeds of closing in. Therefore, fighter airplanes must execute some kind of maneuver, placing them in an initial position for attack when they meet the enemy in head-on courses. Generally, this must be a 180° turn or any other maneuver close to it. Execution of such maneuvers requires time during which the enemy can break away from the fighters - at a great distance. The pursuit might require much time, and, in many cases, may make the attack impossible.

Until now we were talking about the conditions of active search, whose proper execution depends completely on the pilot. However, under modern combat conditions, when the speeds and altitudes of airplanes are considerably increased, it is impossible to carry on active visual search without the help of ground radar.

When undertaking a visual search, the airplanes of the enemy can be located more readily in head-on courses. It is also known that attacks by head-on courses are less effective than by altitude courses, because of

Let us demonstrate this on an example. Suppose that the fighters have located enemy bombers traveling at a speed of 800 km/hr in a head-on course. After the enemy has been located, the fighters execute a turn of 180° which ensures them an attacking position in about 2 min. During this time, the bombers will break away at a distance of 30 km. If, after accomplishing the turn, the fighters would pursue the enemy at a speed equal to 980 km/hr, they would be able to overtake the enemy only in 10 min. At this time, the bombers will have covered 133 km of the assigned course. It may happen that this distance will be sufficient for the bombers to attack the

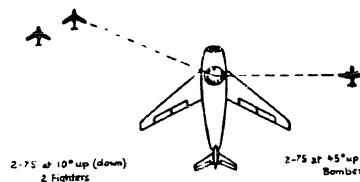


Fig. 7 - Time Interval Method of Data Transmission

objective patrolled by the fighters.

From this example it is obvious that the fighters must start the maneuver of going into the initial position for attack, long before the enemy is seen. This is possible only when the fighters are being guided from the ground. Command posts of fighter aviation carry on the air observation by means of ground radar and transmit information on the position of enemy fighters. Being informed by radar about the enemy and its own fighters, the officer at the command post or at the point of guidance can direct his aircraft to the position bringing them close to the enemy on the longitudinal course. That permits the fighters to enter the combat immediately after the enemy was visually detected or located by airplane radar.

However, when using radar, it is always necessary to try to direct the fighters

to a height exceeding that of the enemy, so that they can use the meteorological conditions for the purpose of camouflage.

In the process of training, the navigators, while guiding their fighters to the enemy by means of radar, sometimes do not consider the position of the sun relative to the target, thus forcing to search for the target from out of the sun, which complicates the search. It is recommended to increase the course but always to guide the fighters to the enemy toward the sun, thus improving the conditions for its discovery (See Fig.2a). This will help make the search more active, decisive, and consequently render it effective.

TRAINING AND EDUCATION HIGH ALTITUDE BOMBING

by

Hero of the Soviet Union, Major General of the Air Force

S.Ushakov.

About 40 years ago, in Moscow, the father of Russian aviation Nikolay Egorovich Zhukovskiy made a report on airplane bombing. In 1916, this report was published under the title "Aerial Bombing". Since then aviation has progressed tremendously. It is armed now with high-speed jet bombers with modern optical and radar bombsights. Bombardment aviation has developed into a powerful force capable of bombing various objectives in any weather condition, day or night, from various altitudes.

The basic function of bombardment aviation is bombing. Bombs are released from a certain altitude and speed, at a certain point in space, from where they will surprise the objective accurately. Therefore, the process of bombing can be characterized by the altitude of flight, airplane speed at the moment of release, and by the wind vector.

The progress in bombardment aviation shows a constant striving for high accuracy in high-altitude and high-speed bombing. That is perfectly understandable. Constant perfection in antiaircraft artillery forces the bomber crews to climb to greater altitudes. Besides that, at high altitudes and speeds of flight it is considerably easier to evade strong antiaircraft enemy defense, consisting of improved fighter aviation. That is why the problem of training of the bomber crew is of vital importance.

How does high-altitude bombing differ from bombing from medium altitudes?

First of all it is worthwhile to mention that it produces errors similar to those which occur in bombing from lower altitudes, with the only difference that by the same aiming error the linear magnitude of bomb deflection from the target will increase with the increase in altitude. If the errors made by the crew when aiming from medium altitudes, lead to a linear deflection from the target not interfering with the accomplishment of the mission, an equal error in high-altitude bombing might interfere. Therefore, it is necessary to find ways for minimizing the personnel errors of the crew and for helping the bomber crew to acquire the skill necessary for high-altitude bombing.

High-altitude flights are inseparable from high speed. This can be explained by the fact that the greater the altitude, the less is the density of the surrounding air and, consequently, the greater is the minimum speed at which a horizontal flight is possible. It can be accepted as correct that the speed necessary for a horizontal flight, e.g., at an altitude of 11,000 m, is twice the speed required for a flight at low altitudes.

Besides that, by developing high cruising speeds at high altitudes, modern bombers maintain the required stability and maneuverability. Every decrease in the cruising speed of the flight leads to an increase in fuel consumption and causes a reduction in the tactical possibilities of a bomber.

It is appropriate to mention that the stability and controllability of an airplane and also the angular travel of a target, when bombing from a jet bomber from high altitudes (but lower than the practical ceiling for the given gross weight) and at high speeds, does not differ much from the similar characteristics of medium-altitude bombing at medium speeds.

A jet airplane, traveling horizontally, experiences no vibrations or jolting, since the absence of an unbalanced and reciprocating working mass permits smooth engine performances. However, by flying at high altitudes, an airplane is more passive, which introduces certain peculiarities to the process of lateral aiming.

The peculiarities of high-altitude bombing also include poor visibility of ground objectives. It is a fact that small vertical angles result in great distance to the observed objectives. Because of the constantly present haze, especially when the objective is located in large industrial areas, the detection of objectives becomes even more difficult. From this it follows that, by bombing with an optical sight, it is necessary to achieve range and lateral aiming by vertical angles close to the angle of elevation (departure); in addition, the bombardier must be experienced in aiming with the required accuracy within a very short period of time.

Another circumstance must be mentioned. During high-altitude bombing, even with considerably good visibility of the objectives when the cloudiness is only several points, the navigator is operating under difficult conditions since he is unable to sight the target at large angles of elevation. These peculiarities cause increased demands on the flying personnel and primarily on the navigators of bombardment aviation. To accomplish high-altitude bombing, as well as medium-altitude bombing, it is necessary to establish the basic meaning of the underlying problems. One of the most important problems is the calculating of the bombing chart.

For every separate method of bombing (level flight, diving, etc.) there exists a corresponding firing table, which gives the reciprocal position of the airplane and the aiming point of the target. If the bombing is done strictly in accordance with the firing table, a bomb released from the airplane must surprise the target. If the bombing does not correspond to the calculations on the firing table, the bomb will fall with a deflection from the target in range or in direction, or in distance and direction simultaneously.

Consequently, it is important to strive toward minimizing the bombing errors and toward keeping the bomb deviation from a target to a value not exceeding the effective radius.

It is necessary to remember that every deviation above the limits of so-called technical dispersion, created by the ballistics of bombs or by some imperfect aiming technique, are the result of action of the crew and depend on its skill in using

this technique. Basically, level-flight bombardment is less accurate than dive bombing, although bombing from horizontal flight is considerably simpler. Progressive development of the aiming technique, especially the stabilization of vertical sights and the development of various designs for automatic computers and automatic pilots, have increased the accuracy of horizontal bombing so much as to introduce this method as basic procedure.

Therefore, in the future we shall consider only level-flight bombardment.

The process of aiming in a bombing attack is subdivided into two parts: directional aiming (lateral) and range aiming (synchronization). Directional aiming consists of bringing an airplane by means of turning maneuvers into such a position relative to the target, that the line of impact would pass through the target.

The quality of aiming in battle depends on existing dynamic phenomena that considerably complicate the directional aiming. Therefore, at the present time, lateral aiming is performed by automatic pilots.

Long-range aiming consists in reaching the point of impact after accomplishment of lateral aiming. Speaking differently, it can be represented as a right-angled triangle, with the bombing altitude and deflection as sides and with the line of sights on the target as the hypotenuse (slant range to the target). The problem of distance thus consists of determining the factors by which the elevation angles would be constructed (the angle between the vertical of aiming and the line of sight). The precision of bombing depends on the accuracy of the parameters of the geometric scheme of aiming in distance and direction.

Since the actual aiming pattern is decided by instruments operated by a navigator (or by several members of the crew), the errors due to the construction of the pattern depend on the accuracy of operation of the instruments. These errors can be divided into technical, constant for certain conditions of bombing, and operational variable errors, depending on the skill and training of the navigator (bombardier) who operates these instruments.

The skill of the navigator is a combination of thorough theoretical knowledge of the process of bombing, familiarity with construction and parts of the bombsight, and operation skill that minimizes the personal errors in operating the sight.

What are the personal errors of the navigator and how can they be eliminated?

First of all, these include the errors created by an inaccurate determination of the air speed. If the true air speed differs from the calculated speed by the navigator, the computing devices of the bombsight will introduce an incorrect number of revolutions of the friction disk, time of fall of the bomb, and lag. At the same error of calculating the flying speed, the deviation of the bomb from the target will increase with increasing altitude of bombing.

There may be many causes of producing errors in determining the true air speed. For example, an error can occur as a result of incompetent calculations of the free air speed with the navigator's slide rule. Many a navigator neglects the correction for temperature of the ram air. They forget that the correction for the temperature of the ram air is of considerable magnitude. To avoid the errors in determining the free air speed, it is necessary to take into consideration the change in speed when the bomb bay is opened during the bomb release. It is necessary to know thoroughly and to consider carefully the aerodynamic corrections on the speed indicator and the corrections for compressibility, and to maintain the speed established by the navigator.

In the process of high-altitude bombing it is important to know and to consider thoroughly the errors caused by an incorrectly determined free altitude of flight. If the actual altitude differs from the calculated, then the magnitude of bomb lag and the rpm of the friction disk are introduced into the bombsight, together with the errors.

What is the reason for these errors?

Suppose that the altitude of bombing was incorrectly calculated with a navigator's slide rule, or to state it more correctly, without considering the necessary corrections (frequently, navigators neglect the corrections for the temperature of

the ram air). In another case, he may neglect to determine the altitude of flight by means of a radio altimeter; an incorrectly determined altitude of flight could be a result of improper calibration of the instrument.

Sometimes the free altitude of flight is determined not in the region of the target but from a considerable distance without taking the character of the locality into consideration. This also leads to an error in determining the altitude of bombing. All crew members should be cautioned to strictly maintain the required altitude of flight.

Errors may be due to incorrect synchronization. In such a case, an additional value of ground speed and range angle, causing a deviation of the bomb, are introduced in the aiming. The only possible cause in this case is the inexperience of the navigator. A poorly trained navigator, when synchronizing, is unable to determine the necessary turning angle of the synchronization lever for the position of the target relative to the reticle; as a result he may turn the handle in both directions and thus does not accomplish synchronization.

When a systematic error (correction for slant range) of radar gun-laying is disregarded, the bomb will deviate from the target, even at accurate synchronization. This can be explained by the fact that synchronization is actually completed by proper correction for slant range to future position.

Finally, an error may be introduced by incorrect selection or determination of the drift angle. This is the result of incompetently executed sighting by the navigator. It is necessary to mention that the greater the altitude of bombing, the greater will be the deviation of the bomb from the target, allowing the same error in lateral aiming. The lateral deviation of a bomb from the target increases with an increase in altitude and speed, allowing the same error for both cases, in direct proportion to the speed multiplied by the square root of the flight altitude.

Proper training in the high-altitude bombing can be subdivided into three stages: general training (theory of bombing), direct preparation for bombing from an

airplane of a certain type on the ground, (study of theory and construction of the sight and armaments, theory of errors in bombing with certain sights, mastering the use of sights by practical training) and practical bombing flights in training and combat airplanes. Since every one of the mentioned stages has its peculiarities we shall analyze them in detail.

We stated that the precision of bombing can be described as the accuracy in constructing the actual sighting pattern with respect to the firing table. This can be done properly only if the trainee clearly understands what and how it must be done. Therefore, the basic principles of the theory of bombing must be understood in such a way that the crew, when operating in the air, is fully familiar with the physical sense, laws, and causes of changes in all elements of the bomb trajectory. This is one of the prime requisites.

Unfortunately, the opinion is frequently held that the aiming technique is too complicated and therefore it is of no practical value to require its thorough study by the flying personnel, and that it is sufficient to know the purpose of the various levers and knobs and the order of their use during operation.

This outlook is wrong and unhealthy.

More complicated bombing devices require a better theoretical training and a deeper understanding of the physical aspect of every part and the operating principles of the entire sight. Without this it is impossible to get practical experience and gain basic knowledge in operating the sight and in mastering high-altitude precision bombing.

Let us illustrate this on an example: Suppose, while executing a range calibration of the aiming point on the radar sight in the air, the navigator were unable to accomplish the required calibration of the zero range. If the navigator is unfamiliar with the functional system of calibration, he surely will take the next decision that bombing cannot be undertaken because the sight is out of order. However, such a decision is wrong. The sight is in perfect order, and the error in calibration can be easily compensated by using a different correction for the slant range.

Here is another example: In the process of preparation of the optical sight, by determining data for bombing, the navigator had not considered the lag factor and computed the synchronization without it. Before releasing the bomb, he noticed his error and, to correct it, he introduced the lag factor after the synchronization was done. A theoretically trained navigator would not make such a decision. It is evident that, by introducing the magnitude for lag without a subsequent correction for synchronization it is impossible to correct the existing error but only to increase it.

The mentioned examples prove that the lack of thorough knowledge of the parts of the sight and unfamiliarity with the theory of errors in bombing with a given sight, are equivalent to bombing "blind".

A complicated bombing technique demands experienced handling of the instruments. Under such experience, with respect to the navigator and pilot of a fighter aircraft we understand: a correct calculation and introduction into the aiming of all initial data for formation of the range angle; skillful and conscientious operation of the aiming knobs, and operation of the bombardment levers during the combat mission, by lateral and distance aiming (synchronization); accurate operation of all parts of the sight, bombing weapons, automatic pilot and flight control instruments; and, finally, skillful regulation and adjusting of the automatic pilot.

How can such experience be gained?

Experience in operating the instruments is not gained at once but gradually, by means of systematic training on the ground and in the air. Every training session should correspond to the degree of preparedness of the navigator and all members of the crew separately.

To minimize the errors of bombing, it is necessary to master the control instruments, to calculate correctly, and to introduce the initial data in aiming. This kind of training must be timed with the analysis of errors, admitted in practical bombardment because a thorough analysis will add special interest and life to the training.

Suppose that, at the end of lateral aiming, a navigator observes a sharp deviation of the target from the course. Examining the reason, he decides that the drift angle had been determined incorrectly and takes all possible measures for its correction. However, the bomb fails to surprise the target. An experienced training instructor will be able to detect the actual cause of the deviation from the course, namely, design peculiarities of the sight itself. The instructor will request the navigator to study these peculiarities and will conduct the necessary training. During the next flight, the navigator will then be able to act correctly. Thus, a good method of crew training and education consists in the timely discovery of errors and in their elimination. Such a system has been adopted by the subdivision, where the navigator of the division is N.I. Zaytsev.

However, practical experience has shown that to detect the errors due to the crew is possible only by analyzing all data influencing the actual composition of the bombing chart. Therefore, each bombing should be thoroughly analyzed and given an objective evaluation. In such a case, logs, photo and firing ground data become the basic documents for an analysis and evaluation of the results of the mission.

Using the results of the analysis of each bombing run, the commander investigates the errors made only by the crew in navigational elements of the flight, in calculating and determining the firing data and introducing them into the aiming, in executing range and lateral aiming, in determining the instant of bomb release, in working with the sight, bombardment weapons and navigational equipment of the airplane during the control stage and combat mission.

To make such analyses more objective, the navigation members of the crew must record in the logs the course magnitudes, drift angle, elevation angle, free altitude and speed, revolutions of the friction disk, lag and other elements, established by the sight in the process of aiming. An expert analysis of these data will help to master high-altitude bombing and to find new ways for further improvement in accuracy.

To avoid the mentioned errors, it is necessary to control the students by practical training. To carry on such training, the instructor should try to teach basic skills in combat sighting and synchronization and also to establish a more expedient sequence of operation for the sight and airplane armament. Special attention should be given to the smoothness of operation of the bombsight knobs. After all errors are eliminated, the instructor plans a flight in a training plane, during which he checks actual work in the air; after this, he draws his conclusions as to the readiness for flight in actual combat aircraft.

The practical training makes it possible for the crew to acquire the necessary complex of practical experience in bombing from a horizontal flight, when altitude and speed are constant, and to solve a series of navigation problems. However, studies in bombardment model training cannot fully replace the practical bombing. Therefore, a regular bombing run should be included as the basic element in combat training of the crew of bombardment aviation.

What is the method of training for practical high-altitude bombardment?

Some commanders consider optical bombardment in the first line and then only bombing with a radar sight. This type of bombing must be conducted at medium altitudes and at speeds which should be increased gradually. The reason given for this attitude is the fact that high-altitude bombing has some peculiarities which are hard to overcome without first mastering medium-altitude bombing at medium speeds.

However, officers V.A.Trekhin and B.I.Frolov (whose opinions we share) have a different point of view.

To use the above-mentioned order of high-altitude bombing, means to be dependent on weather conditions and to start the mastering of high-altitude bombing only in weather that would permit accomplishment of the mission with respect to visibility.

Our opinion is that, after ground training, the crew must make several bombing flights in a trainer, accompanied by the instructor who will make the necessary decisions as to readiness for actual combat missions.

Bombing flights in military airplanes should be accomplished at once from high-

altitudes and at gliding speeds.

The flying crew must be prepared to bomb with different aiming methods, depending on atmospheric conditions. It is preferable to make two bombing runs (using the same or a different polygon).

For future progress in the method of high-altitude bombing at greater accuracy, it is necessary to study the obtained results, to establish standards, and to reject all obsolete methods not corresponding to modern problems.

PILOT ACTIVITY DURING INTERCEPTION

by

Major of Guards

L.Savichëv

A fighter pilot may be given the order to detect and destroy an air enemy at any moment, day or night, under most unfavorable meteorological conditions.

Actual experience has shown that only an efficient pilot, who is ready to fight the enemy by all existing ways and means, can successfully accomplish this task.

The reason for this efficiency of pilots, as well as of any other soldiers of the Soviet armies, is their high sense of duty to the Fatherland, the Communist Party, and the Soviet people and their excellent combat skill. Therefore, in speaking of combat activity it is necessary, first of all, to strive toward the development of high political reliability and perfect mastering of arms and combat technique in the soldiers.

The development of genuine combat efficiency in pilots is promoted by their profession, their every-day activity, which consists in protecting the aerial borders of our Fatherland.

As is known, the art of intercepting and surprising aerial targets is one of the most important elements of combat preparedness of fighter pilots. Recognizing the importance of this problem, the commanders of our aviation units are constantly developing combat skill in the pilots, and their efficiency in intercepting aerial targets.

An interception mission is usually accomplished by the officers of the ground control, in cooperation with a pilot in the air. Therefore, the success of the mission depends not only on the accuracy of aiming but also on the efficient and decisive action of the pilot, especially during search for a target and, after its location, on the swift and accurate execution of the received order.

The role of moral and combat qualities increases considerably in significance when the problem of intercepting is complicated by difficult weather conditions and especially by clouds. The search, closing-in, and guidance to the target which is hidden by clouds, usually have to take place without the possibility of visual detection. The fighter pilot, guiding the plane by instruments, must simultaneously observe the image of the target in the sights. This fact demands constant readiness to change the course of the flight swiftly and sharply, to keep the target in the visible zone of radar range and, after closing-in to within firing range, to open fire and surprise the target immediately.

The highly efficient commanders of our units, who understand the importance of these problems, are doing everything possible to establish proper training for the pilots when in the air. Experienced teaching gives positive results. Among the pilots of our units there are many true masters of aerial combats and sniper practice. These include: Major P.P.Panchenko, Captains S.G.Bryukhanov, V.V.Kononov, V.I.Stekol'nikov, First Lieutenant Yu.D.Basilevich, and others, who mastered the art of intercepting aerial targets to perfection. While accomplishing the interception of aerial targets, these pilots act decisively in the air, attacking swiftly, and surprising the targets accurately with fire from the waist guns of the airplanes. They mastered the art of control by instrument, acquired experience in intercepting aerial targets under simple and complex meteorological conditions, day or night. For example, Captain S.G.Bryukhanov, while tracking a target on the radar screen and while approaching it, immediately counteracts any target maneuvers permitting attack and destruction from within the firing range.

Usually, the time required by him for closing-in is the least possible, thus ensuring the success of the first attack. Such a pilot can be guided to the target by the control post without difficulty. Not limiting himself to the data received from the control post, he develops action and takes the initiative in the search and in the manner of attack on the target.

Unfortunately, there is still a certain careless attitude toward training, with respect to the pilot's activity. This shows in a certain type of "breaking-in" the pilot with respect to specific action in the air, under simplified conditions. In some such cases, the course of the aerial targets is announced beforehand, and the "target" itself is passive, especially at the moment of interception. It is clear that, under such circumstances, no intensive action is required of the pilot, undertaking the interception. Both search and guidance are simple for the pilot and for the control post. This method simply constitutes a formality which paralyzes all initiative and activity of anyone taking part in the organization of interception of aerial targets. It is necessary to consider that, in carrying out actual combat assignments, the pilot is obliged to fly under any weather conditions at any hour of day or night. The problem of interception becomes more complicated when considering that the enemy will use all possible means and maneuvers to prevent it from being detected. Therefore, it is desirable to promote pilots who show initiative and inventiveness and to demonstrate to all flying personnel the advantages of the Soviet fighter aircraft with their first-rate equipment, which permits a successful solution of the problems of interception of maneuvering targets.

In practical training, there are cases when the training for the interception of moving aerial targets is done without proper reasoning and without taking into account the possibilities of radar equipment and preparedness of the personnel. For example, fighter pilots are instructed in some of these courses to pursue a maneuvering target under complex weather conditions day and night, keeping the distance at which it was detected. Advocates of this method suggest that the pilot, at this distance, adjust the speed of his craft to the speed of the target and wait until it

stops maneuvering , and only then approach and attack it. In cases in which the maneuvering tactics of the target are intensive, it is suggested to break away from the firing range at the point of detection, i.e., to break away from the target with the intention of later repeating the maneuver. It seems to us that such recommendations and suggestions damage and paralyze the pilot's efficiency and develop inertness. In such a case, the initiative is voluntarily left to the enemy.

Practice shows that even a slight delay in the pilot's action after detection of the target, runs the risk of having it disappear from the zone of observation, causing loss of time and repetition of the aiming process, which is not always possible.

To pursue a target at the distance of visual detection is much more complicated than at the distance of aiming since it cannot be clearly identified in the sight; this makes it more difficult to determine the beginning of the maneuver and to track the target during this time. Because of this, it is difficult to keep on the track of the target which can thus escape the interceptor by a sharp maneuver. Besides that, in such a pursuit, the element of surprise and swift action is lost, and the crew of the pursued airplane has a possibility of taking measures for interfering with the action of the interceptor.

The first attack, as is generally known, is the most effective. Any repeat attack on modern high-speed targets demands repetition of aiming, resulting in a loss of time and interfering with the action of the pilot. Therefore, we teach fighter pilots to act swiftly and to close in on a target immediately. For this purpose they are taught to approach the target at high speed after it has been detected and to pursue it at firing range so that the proper moment of firing can be selected.

In a pursuit at this distance, effective use of airborne radar becomes possible in view of the fact that the scope will clearly show the maneuvers of the target thus permitting its exposure, even in cases of intricate maneuvering of the target. Besides, an airplane interceptor will stay in the effective range of radar and of

the enemy fire for only a minimum period of time, a fact that will ensure the surprise element of the attack. With this system of training, a pilot can acquire the necessary and vital experience in aiming and firing at maneuvering targets.

In connection with this, it seems to us that it is necessary to inform the pilot of the speed of approach only at the beginning of the training in interception of maneuvering targets under difficult meteorological conditions. After a certain practical experience has been gained, this becomes unnecessary, since it will only foster inertness. Experienced pilots, when confronted with actual conditions, can determine by themselves the speed of approach and try to destroy the enemy in the shortest possible time.

Experience shows that, in cases when the pilot uses a minimum of time for approaching the targets to within firing range, the attack is usually successful. Conversely, if a pilot approaches the target at low speed, it becomes difficult to keep it in the field of view, since the pursuer is forced into sharp maneuverings which interferes with ground control and reduces the chances of successful attack.

As an example, we are demonstrating the case of First Lieutenant N.V. Galkin who acquired certain experience in the control of aircraft by instruments, as a result of systematic training. However, his actions in the air were not always aggressive and he was not always able to pursue an intensively maneuvering target and keep it in his field of view, resulting in repeat aiming.

Only persistent, daily tutoring of First Lieutenant Galkin together with a timely analysis of his errors and a careful control of his actions when in the air, have helped to cure him of these faults.

We make extensive use of the experience of outstanding pilots for developing efficient combat qualities. Impressive examples, demonstrated by commanders and political instructors, show that success can be secured by a combination of action and determination of the pilot in the air with clever initiative. For example, a pilot taking energetic, swift, and tactically proper action in the air would attack the target and successfully accomplish the mission. When analyzing the flights in

staff meetings, the commanders and political instructors should make a list of pilots who visibly demonstrated the results of air action. This should be accompanied by organized analyses of negative achievements so that the pilots are given an opportunity to study the errors of their colleagues.



A group with Captain A.I.Yakhnenko as the commander, occupies the first place in the unit in political combat training.

In the photo: The commander of the group, Captain A.I.Yakhnenko (first left), analyzes the actions of pilots in intercepting aerial targets.

Photo V.Fedosova

Personal demonstrations by the commander are an important item in developing combat efficiency. Sometimes, on return from a training flight, e.g., after an unsuccessful interception of an intensively maneuvering target, some pilots will try to attribute their failure to different objective causes. In such a case, the commander should take off and prove in practice that, even under complicated conditions, it is possible to accomplish the assignment successfully and that the cause of the failure did not lie with the technique or the guidance service but with the pilot himself, who did not develop the required efficiency in the air. Being

convinced of their error by the demonstration of their commander, the pilots usually will study more efficiently, trying to imitate the commander, and will begin to act courageously and resolutely in the air.

Ever increasing devotion to the profession and to modern technique by the Soviet people is of great importance in the training of active air fighters, capable of carrying out the given assignment under any conditions. There is no need to prove that a pilot, who loves his profession, has a better chance for successful accomplishment of his duties by constantly improving his habits and discovering new ways for perfecting his combat skill. Such an air soldier, while being on duty, will use all possible means for discharging it with high honors.

DETERMINING THE FLIGHT COURSE OF AN AIRPLANE IN THE CIRCUMPOLAR REGION

by

Chief Navigator of Polar Aviation
V. Akkuratov

The existing cartographic projections are of small practical values for air navigation at high latitudes in the circumpolar regions. Their use in flight can lead to unexpected results. For example, suppose that the flight will be undertaken from Cape Chelyuskin over the Pole to the Land of Elsmir. The navigator, guiding the airplane by astrocompass (magnetic compasses give incorrect readings in this region) will encounter many difficulties.

Assume that the course of the airplane is equal to 360° . At the moment when the airplane crosses the Pole its course changes from 360° to 180° , although the airplane will continue its flight along the same straight line, deviating not even one degree to right or left. The navigator will be in an even more confusing situation by the change in course at the point of the Pole. Here, his course will always be 180° , disregarding the direction of flight. If the navigator attempted to describe a square around the Pole, he would meet so many course changes on each of its sides that this could easily confuse even the most experienced navigator who is not familiar with flying conditions in polar regions.

All this handicaps the action of the crew in polar regions and high latitudes. To overcome the difficulties in determining the course in circumpolar regions, which are produced by convergence of the meridians at the point of the geographic pole, it was necessary, first of all, to compensate for this basic condition. It

should be mentioned that all cartographic projections were compiled for use in accessible latitudes. For this purpose it was very convenient to direct all meridians to one point which is called the geographic pole. However, for airplane navigation in high latitudes such a cartographic grid is inconvenient. Therefore, the airplane navigators had accepted a method of navigating by the chart of pseudomeridians. This

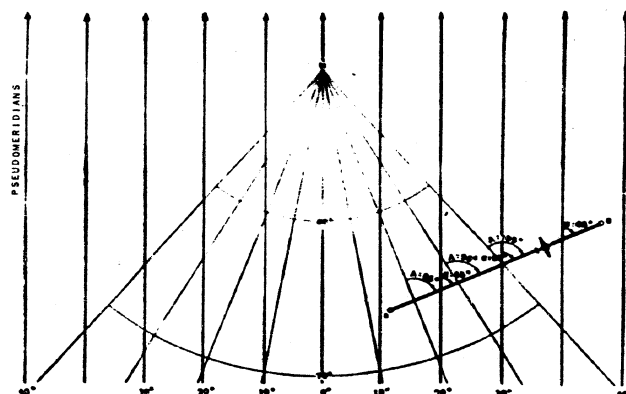


Fig. 1 - Schematic Drawing for Establishing the Course by the Grid of Pseudomeridians

method was first used in 1937 by the crew of airplane N-169, while accomplishing a flight to the floating station "North Pole I".

The principle of this method consists in the following facts: The point of geographic pole is shifted into infinity. In this case, all meridians of any central projection are parallel. Geometry states that in the case when two parallel lines are intersected by a straight line (in the given case the line of the course) equal angles are formed. Therefore, the courses chosen at any given segments (Fig. 1) will be equal.

This method of course tracking excludes all unexpected factors which could be encountered in the general cartographic projection. Thus, at the moment of crossing the point of the pole and, consequently, during the subsequent flight along a straight line, the course of the airplane remains unchanged. Exactly this happens when describing a square about the pole. The course will change only four times, i.e., as many times as segments of the straight lines exist. The pole will possess all the directions of the world (North, South, West, and East.)

Let us examine this on the graphs shown here (Figs.1 and 2). Let us use the following symbols:

a-b = Course of the flight;

A = Azimuth (course) by the conventional system of meridians;

α = Azimuth of the same direction (course) by the new system of meridians;

λ = West and east longitude.

Conversion of the courses from one system to another:

$$1) A = \alpha \pm \lambda \begin{array}{l} \text{east} \\ \text{west} \end{array}$$

$$2) \alpha = A \mp \lambda \begin{array}{l} \text{east} \\ \text{west} \end{array}$$

This grid is formed as follows: On a map of stereographic projection, as the most convenient type for high latitudes, are drawn straight lines parallel to the Greenwich meridian at any accepted distances, in relation to which the courses are traced. Any meridian (most convenient is the center meridian of the zone of flight) can be accepted as the initial meridian since, by selecting such a meridian, the course will correspond better to the standard position.

This method can be recommended to all navigators who theoretically have mastered the new method. The use of this method by persons without sufficient theoretical knowledge can cause confusion and inability to complete the mission.

During the high-latitude expedition in 1954, the method of navigation by pseudomeridians was successfully used by many navigators for day and night flights.

At present, there exist maps of stereographic projections published for use in polar aviation, with the grid of pseudomeridians traced on it at the scale of 1:3,000,000.

On this map, pseudomeridians are drawn parallel to the Greenwich meridian and the second group - parallel to the meridian of 90° E Lat. - is given as the center meridian of the Soviet Arctic.

During the flight by astrocompasses of various systems, some computations are necessary. Suppose that the crew operating in the western sector of Arctica is

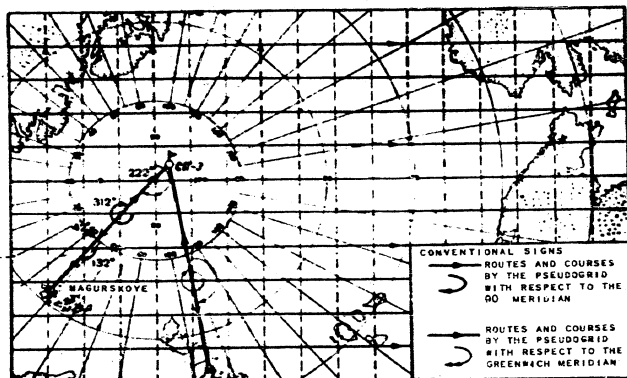


Fig. 2 - A Map with Pseudomeridians

taking off from Nagurskoye in a straight direction across the geographic pole toward the station "North Pole-3" situated somewhere outside the Pole, along the meridian 228°. It has been decided to fly by pseudogrid (the Greenwich meridian has been accepted as the principal). A time angle of Greenwich light is established by astrocompass, and the course is prepared by the pseudogrid, i.e., relative to the Greenwich meridian.

In this case, the course will be equal to 312°. Maintaining it by astrocompass or by GPK and introducing corrections for deviations, errors of the instrument and

accidental side deflections, the navigator will guide the airplane exactly through the Pole toward "North Pole-3". On the way back from N.P.3 toward Nagurskoe, the course by the pseudogrid will be equal to $312-180^\circ$, i.e., 132° .

When a decision to carry the computations by meridian 90° has been made, the course is prepared relative to the 90° meridian and the time angle on the astrocompass is established with respect to the latitude of 90° .

It should be remembered that in all cases, the latitude on the astrocompass is established equal to the meridian, relative to which the course is prepared.

CATAPULT TRAINING

by

Lieutenant Colonel

V. Matyushko

High flying speed is a specific characteristic of modern aircraft. To bail out of such an airplane in case of emergency by the regular method, i.e., by dropping over the side of the airplane, is not simple, since the existing aerodynamic forces are very hard to overcome. Besides that, there exists the danger that the crew member who is forced to bail out will get tangled with the tail assembly.

Therefore, in cases when it is necessary to bail out of an aircraft moving at high speed, catapults are used.

Catapulting is one of the most reliable methods of forced ejection from high-speed airplanes.

Usually, before catapulting is mastered in the air, it is preceded by intensive theoretical study and ground training, which give practical skill in forced bail-outs from high-speed airplanes in the air. To acquire this skill, we used a special trainer, fitted with various instruments required for assembling and disassembling of firing mechanisms, and also with pyrocartridges of a certain multiple overload. Such trainings are conducted under the supervision of an experienced instructor, who is assisted by a technician, two mechanics responsible for the armament, and parachute riggers. These are all subordinate to the training instructor and under his direction, accomplish the work which is connected with catapult training.

In organizing the training schedule, it is important to decide on the positions of the members of the group in the trainer, visual aids necessary for the study, and

typical questions to be asked of the students, etc. During the theoretical training, we first of all try to explain the advantages of the catapult ejection over the simple drop over the side of the airplane, the mechanism of action of catapulting, and then proceed to the practical mastering of the mechanism and rules for catapulting from a trainer.

The first experimental training in catapulting as a rule, is accomplished by the training instructor himself, or by an experienced parachute rigger, or by a pilot who has experience in ground catapulting. Later the students are allowed to practice catapulting by means of a trainer. Naturally, before each session, every student undergoes a medical examination performed by a physician attending each training session.

The instructor, standing on a platform in the cabin, close to the switch for controlling the gears, announces the commands in a clear and loud voice so that the latter will be remembered by the students.

Here, pilot Yu.A.Gorbanev, is adjusting a parachute and approaching the instructor. He reports: "Pilot Gorbanev ready for catapult training". The instructor carefully examines the cabin, the attached straps, the lever of the gear switch and then gives permission to occupy a seat in the trainer.

During the work in the trainer, the instructor must allow no contingencies. The pilot performs all operations in exactly the way he would use when preparing for bail-out during an actual flight.

After placing himself in the cabin, the student fastens a safety belt and tightens the straps, tying his body to the back of the seat and fixing the seat by a set screw. The instructor must be sure that the back of the pilot is tightly propped against the back of the seat and that the whole body is straight; the head must be rigidly fixed against the head support, with the feet resting on the footboard of the seat and the knees touching. A proper position permits a uniform distribution of the multiple overload, created by catapulting, over the entire body.

Partial relief of the spine can be obtained also by grasping the hand straps of

the seat while pressing the elbows closely to the sides of the body. Only after the instructor is convinced that the pilot has fulfilled every condition should the student be allowed to perform catapulting.

The instructor continues his supervision even at the moment when the release button of the trainer is pressed. He makes sure that, before bail-out, the student inhales deeply, closes his eyes tightly, and locks his teeth. At the moment of pressing the release, a shot is heard, and the seat together with the student, moving on coasters along the guide rails, is raised up rapidly. In this raised position, it is fixed by means of special gears. The seat occupant is subject to a considerable overload in the first moment, but all events proceed at such a high speed that his organism is able to withstand the overload comparatively easily. When the seat stops at the highest point of the lift, the student opens the lock of the attached straps and detaches himself from the seat.

The release from the attached straps is usually performed by an instrument, but we always advise the student to open them manually. This applies also to the parachute; it does open automatically, but while accomplishing a training "jump", we demand that the students open the parachute by hand. This develops the necessary habit of opening parachutes and promotes independent behavior in the air.

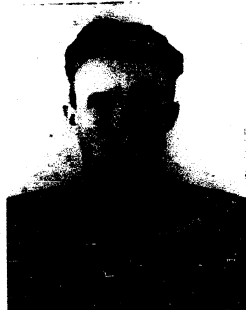
As soon as one of the group has made the "jump", the trainer is immediately prepared for the next catapulting. Pyrotechnicians load the firing mechanism, and the instructor inspects the seat and other accessory devices. This permits rational use of the equipment of the trainer and proper preparation of the flying personnel for withstanding the multiple overload created at the moment of separation from an airplane flying at high speed.

PILOT- INSTRUCTOR

by

Major A.Nazarov

An airplane was coming in for a landing. It accomplished the fourth turn and, going into a glide, started to approach the landing path. In the pilot cabin was cadet Dervanov. This was his first independent flight in a jet aircraft, and he



First Lieutenant
A.A.Koznov

knew that his action was being observed by tens of alert eyes of his colleagues and commanders from the ground. Aware of the responsibility for the result of his first flight, cadet Dervanov accomplished, as he thought, a very accurate landing computations, securing for him the landing at the particular mark T.

The earth was moving swiftly under his aircraft, and for a moment the panels of the mark appeared before his eyes and vanished somewhere behind. However, the jolt characteristic of a landing did not follow. At

last the jolt was felt, and the cadet realized that the landing had been made with overshooting the mark. Failure!

Yes, this error was taken very hard by the cadet. In the analysis of flights during a special bull session, the pilot-instructor, First Lt.A.A.Koznov said:

"The fourth approach was accomplished correctly by cadet Dervanov, as far as required distance and altitude were concerned, but the landing was not correct. Such errors were committed also by several other cadets. Why? The cause is only one: they do not have enough experience in operating mechanisms so that their gliding speed was too high."

Officer Koznov drew close to Dervanov and looking straight into his eyes continued:

"And you, Dervanov, do not give up. We shall correct this error with hard work and study, we know how to eliminate the errors, don't we?"

"Right" - answered the cadet nervously, and recalling the past month of training added: "We had some previous errors, Comrade First Lieutenant. We cannot forget the past."

"Then everything is all right. And now let us move from words to deeds," - concluded instructor Koznov.

Soon the cadets and the instructor were at the trainer. Officer Koznov explained to Dervanov and other cadets how they have to take into account the peculiarities of operation of the jet engines and how to reach the required gliding speed. After that, while training in the cabin of the airplane, the cadets started to acquire experience in handling the engine on landing.

After the intensive work in the trainer was finished, the instructor took every cadet for a check flight, during which his attention was mainly directed to the engine handling by the cadet, especially during an approach for landing. During this flight, cadet Dervanov landed his plane faultlessly; the honors for his achievement he should share with his immediate superior and instructor, officer Koznov.

In the practical experience of the pilot-instructor, First Lt. Anatoliy Andreyevich Koznov, are many examples of meticulous work with cadets. For many years he has been occupying the position of an educator for young pilot fighters at an aviation school, named after the great pilot V.P. Chkalov. During these years he established himself as an experienced master of education and training of young avia-

tors. During several years of his work with the school he trained many young men, who came there with the passionate desire to become pilot-fighters, skillful defenders of the aerial borders of our Fatherland.

Pilot-instructor Koznov's skill fully combines training with educational work, which he has been conducting with cadets since their first day of arrival at the school. In his work he avoids any set pattern and gives personal attention to every cadet.

Here officer Koznov just received a new group of cadets. Despite the fact that the instructor knew from experience how to start the work with beginners, he accepted the new group with a feeling of great responsibility. He was facing the problem of helping them to achieve the new profession of a combat pilot.

From his own experience every pilot-instructor knows that successful accomplishment of this problem is possible only when one knows the weak and strong sides of each cadet, peculiarities of characters, habits, inclinations, and faults. The study of subordinates is the first problem of officer Koznov. He solves it, along with other instructors, by becoming familiar with the cadet's personal affairs. It is a well-known fact that neither curves nor flight log records can replace personal association with people. Therefore, officer Koznov often calls on his cadets in dormitories and classes. The instructor informs the cadets about the school rules, tells them about the exciting profession of a pilot-fighter, about the glorious traditions of the school, about the great Soviet Jet technique. He tells them with a warm and human feeling about famous pilots of our land, who were trained in the school, about the glorious life of V.P.Chkalov, whose name is so dear to all cadets.

From the first days of acquaintance with the cadets, instructor Koznov had been trying not only to detect the peculiarities of the characters and abilities of his subordinates but also took all necessary measures to increase their activity and their feeling of responsibility for the study.

Let us analyze the case of cadet Dervanov. His records showed that he has slow reflexes and initiative. Besides that, Koznov recorded that the cadet is physically

not fully developed. He did not have the mobility and quickness of reaction that is required of a pilot-fighter. The experienced educator first of all decided to solve the first modest problem which consisted in developing in Dervanov an enthusiasm for physical education and sports. That was not easy. While in class, the cadet was trying to perform all exercises, but without any initiative or eagerness. The instructor could not be satisfied with such a passive attitude toward the problem.

To develop in the cadet an interest in physical education, the instructor studied with him personally many times and demonstrated how the various exercises on parallel bars, high bars, and other sports equipment should be accomplished. He assigned one of Dervanov's friends, cadet Petrov, to help him in athletic exercises. They often talked about Valeriy Chkalov, how strong and skillful he had been and how important athletics are for a pilot. In the evenings, they read books and booklets describing Soviet sportsmen - world record holders. As a result of these efforts by the instructor, Dervanov started to be interested in sports and began to exercise with enthusiasm.

Officer Koznov pays great attention in the work with cadets to military discipline because this is the basis of the fruitful work of the group. From the first days of training, he has been teaching the cadets to live and work by the code. He tries to establish the code discipline everywhere - on the airfield, in class and in dormitories.

Here is a very colorful example: The group is in a theoretical session. During this time, as is well known, the cadets study under the supervision of instructors; together with them in the classroom is officer Koznov.

While checking the papers of the cadets, the instructor discovered that several cadets did not take notes.

This fact resulted in a serious conversation between the instructor and the whole group. He reminded them that V.P.Chkalov, while being a cadet of this school, was persistent in work and with an energy characteristic for him, mastered the art of flying. The instructor knew that the image of the great Soviet pilot, whose name

the school bears, is an inspiring example for every cadet. He explained the tremendous importance of theoretical studies for future mastering of flights in jet airplanes. The instructor requested greater efficiency of studies from the cadets.

Sometime after this conversation, on recommendation by the instructor, at the meeting of the Comsomol, a question of academic advancement was brought up. Methods of theoretical studies were thoroughly discussed by the members of the Comsomol; how they use educational literature during the hours assigned for self-education. The cadets who did not show enough effort in study were severely criticized by the members of the Comsomol. In their resolution, the members of Comsomol decided to render some help to academically weak cadets. All this influenced the academic advancement of the whole group in a positive direction: Only good and excellent marks were received in the examinations on theoretical subjects.

The methodological skill of officer Koznov becomes most evident in the process of flight training. Here the instructor and cadets spend all the time at the training platform and on the field. Koznov directs most of his attention to the rules of engine operation, operation of instruments in the cockpit, ability to take proper decisions under various conditions occurring in flight. As is known, the first practical test is given while training in the cabin of the airplane. He demands accurate and attentive execution of various exercises from every cadet.

It is known that the period of training flights is very important for the development of flying experience. The success of independent flying depends on the experience in the acquired technique of pilotage. Koznov accomplishes this by meticulous and persistent work with each individual cadet.

Once he took off with cadet Volkov. The instructor saw that the cadet did not maintain an even bank when deploying. During this maneuver, Volkov would accomplish banking at a high angle and then, discovering his error with a delay, turn the lever abruptly in the opposite direction. He could not accomplish normal banking by such a manipulation which resulted in vibration of the airplane. The cadet started becoming nervous.

At this moment he heard the quiet voice of his teacher. Over the interphone, the instructor immediately pointed out the errors of the cadet's actions and coached him in the ways of further deploying operations.

"The correction of this error is possible through smooth operation of the lever in the reverse direction" - suggested the instructor to Volokov. "And you have to hold the handle in this position".

The cadet carefully followed the directions and understood the cause of his error.

Nose-up during take-off is especially difficult for cadets in the period of training flights. This is mainly due to old habits acquired in flying piston-type airplanes. To overcome this drawback, the lieutenant used a special training device. Under the nose of the airplane he propped a special block, creating a lever for lifting or lowering the nose of the airplane to the height of the front wheels. This simple device allows each cadet to establish visually one of the elements of take-off or landing.

The independent flights of the cadets is the most responsible period of flight training. Every solo flight, especially in the beginning, is a strong proof for successful completion of the study and also for the efforts and work of the teacher. First lieutenant Koznov is always especially careful in watching the action of the cadets. He carefully records the errors, with the intention of correcting them later.

Extreme caution is a necessary professional characteristic of a pilot. It consists in the ability of a pilot to get a clear and exact understanding of the situation on the ground and in the air and to take some decisions along this line.

The ability to see and perceive the most important elements of the air situation is not an inherited talent. It can be developed through systematic and intensive training. Officer Koznov uses different methods for developing these qualities in his subordinates. From the first days of his work with the cadets, he trains them persistently in memory and observance. He insists on the cadet's remembering

incidences met on his way. The cadets, knowing these demands of the instructor, tried to observe the environment carefully. By developing a sense of caution, the



In This Photo, Pilot-Lieutenant E.V.Belogurov (Left) Under the Supervision of Instructor-Captain Yu.A.Brukhanov, Works Out a Training Lesson at the Trainer

(Photo by T.Melnik)

instructor gradually trains the cadets in correct distribution of their attention and in the ability to emphasize fundamentals.

A fighter pilot, besides having experiences in the technique of pilotage, must be able to surprise the aerial and ground targets accurately. Accurate firing at air targets depends on many factors, including correct maneuvers, exact firing range, determination of target size, and finally, establishing the right moment for opening fire. Officer Koznov persistently develops these qualities in his subordinates. While executing typical attacks, he demands from the cadets energetic action and swiftness of maneuver. Special attention is given to developing the ability of establishing the right moment for firing and the proper moment of withdrawing from

the attack.

This experience can be gained in the process of training with the help of special equipment. Every cadet is trained by the instructor personally. During the sessions he introduces a number of additional conditions and demands solutions within a minimum of time; this gives the possibility of thorough preparation of the cadets for the first training flights.

While practicing firing at ground targets, the instructor pays special attention to the manner of maneuvering on approach to the target, to maintenance of the requested speed and the given diving angle. He also teaches them to operate the sight, demonstrates the manner for tracking, framing, and retaining the target. All this presents a possibility for considerable progress in developing the art of combat operations in airplanes.

The course of training is accomplished. Nervous and happy, the young pilots say good-bye to their school, firmly press the hand of their teacher and educator, pilot-instructor Koznov. Where are they going to fly from now on? Perhaps in the gloomy skies of the Baltic region, or over the massive woods of the Far East, or in the other regions of our limitless Fatherland where they will guide their swift planes, patrolling the peaceful sky of their favorite Fatherland.

"Good luck" - thoughtfully says officer Koznov to his pupils who have acquired their wings. "Continue in the steps of Chkalov and always remember that you are guarding the happiness and the peaceful work of your people. Be worthy of this great honor!"

TECHNIQUE AND PERFORMANCE
 Honorary Worker of Science and Technology, Professor Lt. General
 V. Pyshnov
 (Engineer of Technical Sciences)
 AERODYNAMICS OF SUPERSONIC SPEEDS

2. Effect of High and Low Pressure Waves*

Previously we analyzed the motion of an air wave in a wind tunnel, assuming that the leading end of the wave experiences an intermittent increase in pressure. This fact requires proof. The wave was produced by the movement of a piston but, under real conditions, the velocity of the piston movement could not become sufficiently high. It seems that a gradual acceleration of the piston movement would cause the wave to undergo a gradual increase in pressure.

Let us assume that the piston is moving at a low velocity V , in such a way that its ratio to the velocity of sound in the air a does not exceed 0.1. Then, the general expressions for the computation of a wave would show that the increase in pressure will be equal to $\frac{\Delta p}{p} = \gamma \frac{V}{a} = 1.4 \frac{V}{a}$, while the wave velocity will be $W = a + \frac{1}{2} V$; the increase in temperature created by adiabatic compression will be $\frac{\Delta T}{T} = (1 - \frac{1}{\gamma}) \frac{\Delta p}{p} = 0.4 \frac{V}{a}$; and the velocity of sound, as a result of the increase in temperature, will increase to a value Δa , which we find from the expression $\frac{\Delta a}{a} = \frac{1}{2} \frac{\Delta T}{T} = 0.2 \frac{V}{a}$, $\Delta a = 0.2V$.

Let the initial temperature of the air be 15° or 288° absolute temperature. Then the velocity of sound will be equal to 340 m/sec. Let the piston move at the

* A continuation, for the beginning see "WF" No.1 for 1955.

speed of $V = 34$ m/sec, i.e. $\frac{V}{a} = 0.1$, the initial pressure will be assumed equal to $p = 10,000$ kg/m². Now we can easily determine the pressure increment Δp , the velocity of the wave W , the increase in temperature ΔT , and the increase in the velocity of sound Δa .

$$\frac{\Delta p}{p} = 0.14; \Delta p = 1400 \text{ kg/m}^2; W = 340 + \frac{34}{2} = 357 \text{ m/sec}$$

$$\frac{\Delta T}{T} = 0.04; \Delta T = 11.5^\circ; \Delta a = 6.8 \text{ m/sec}; a_1 = a + \Delta a = 346.8 \text{ m/sec}$$

If now the velocity of the piston movement could be increased by a value of ΔV , a new wave will be created, whose characteristics could be represented by the term $\frac{\Delta V}{a_1}$, considering that it will be moving in an environment of increased pressure and

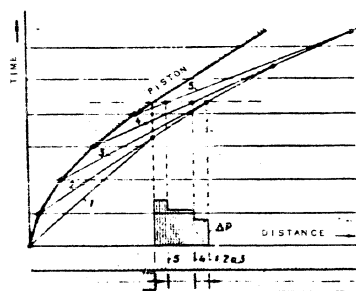


Fig. 7 - Diagram of Motion of Increased Pressure Pulses

temperature. However, the new wave will spread in a surrounding medium of a velocity equal to V , produced by the preceding wave. Therefore, increasing the speed of the piston gradually by a small value, will result in a series of successive waves and in different pressures and temperatures in the surrounding medium, corresponding to them. Such calculation is basically simple but requires many individual computations.

The most interesting fact is that every following wave moves at a greater velocity and will catch up with the preceding wave within a certain time. In the offered example, the speed of the first wave was equal to 357 m/sec; if the second wave is weak, its own speed will at least be equal to the velocity of sound a , i.e. 346.8 m/sec, so that, added to the piston speed of 34 m/sec, the final velocity will

be 380.8 m/sec. This means that the second wave will have a speed advantage of 24 m/sec.

The motion of waves can be conveniently represented graphically. Assume that the path is plotted on the horizontal axis and the time on the vertical (Fig.7). At the instant t , at which the first wave starts moving, its distance as a function of the time can be represented by a straight line whose slope is proportional to its

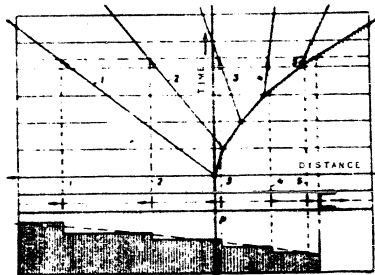


Fig.8 - Diagram of Motion of Increased Pressure Pulses

speed. After a certain time, the second wave starts moving at a slightly higher speed; the other waves are generated later but at still higher speeds. Each new wave moves away from the piston which also is displaced. The displacement of the piston is shown in Fig.7. This graph clearly shows the successive generation of the waves and the change in pressure after the first head wave rises ever higher. The lower part of Fig.7 shows the location of the waves at certain moments.

Suppose that after the discharge of five waves, the speed of the piston remains constant. Then, after a certain time and at a certain distance from the initial point, all waves will sum up and will become one high-power wave - creating a jump in pressure, temperature, and density. The cumulation of a gradually increasing wave into one intense shock wave is an important characteristic of the motion of

waves of increased pressure in the air and, generally, in a gaseous medium. A different picture is obtained when a wave of reduced pressure occurs. Suppose that the piston moves in the tunnel to the right; let us see what will happen in the left side of the tunnel. If the speed of the piston is low, i.e., $\frac{V}{a}$ is low, then we can use the expressions that had been obtained for waves of increased compression, except that, instead of the increase in compression, temperature, and velocity of sound, we shall have a decrease. Thus, the change in pressure will be $\frac{\Delta p}{p} = -1.4 \frac{V}{a}$, the velocity of the wave $W = a - \frac{V}{2}$, the change in temperature $\frac{\Delta T}{T} = 0.285 \frac{\Delta p}{p} = 0.4 \frac{V}{a}$, the change in the velocity of sound $\Delta a = -0.2 V$.

Let us analyze the graph (Fig.8) which is analogous to that shown in Fig.7, but illustrates a gradual advance of waves of decreased compression. Every succeeding wave will travel to the left at an ever decreasing velocity, since the velocity of sound and, consequently, the total movement behind the piston, decrease with increasing exhaustion. Starting at a certain piston speed, the waves will not take the direction to the left, but will follow in the wake of the piston at a lower speed. In Fig.8, the fourth and fifth waves are moving to the right, while the first, second, and third are moving to the left. Every wave produces a decrease in compression; the distribution of the pressure inside the tunnel is shown in the bottom part of the illustration for a certain instant of time. Actually, the gradual increase in the velocity of motion of the piston is accompanied by a smooth and extensive change in the residual pressure of the piston.

Thus, the pressure of the surrounding air medium may increase sharply in the form of a shock wave or may decrease gradually. If the increase in pressure occurs slowly and the change in the pressure itself is small, the pressure discontinuity will occur only at a considerable distance from the source of compression. However, in this case it will weaken as a result of the expansion through a large mass of air. It is known that a violent explosion at a great distance is perceived as a roar and even as a successive repetition of the sound of the roar. The cause of this is the phenomenon of expansion of the compression increment in the atmosphere,

where the temperature changes with the altitude. The change in temperature creates not only a change in velocity of motion of the wave, but also produces a change in the direction of motion. As a result, the wave created by the explosion can move to a certain point over different paths and at different times.

The peculiarity of the wave motion of increased and decreased pressure has an important meaning in creating the characteristic pressure pattern when bodies are passed by a supersonic air stream. We shall return to this question later.

3. Velocity of Exhaust

We have analyzed the motion of air in a tunnel, created by the movement of a piston. A pressure discontinuity occurred at the front of the piston, followed by compression of the air and increase in temperature; the velocity of motion became equal to the piston speed. At the rear of the piston, the density, pressure, and temperature of the air decreased and a motion in the wake of the piston occurred. However, its velocity decreased with an increase in distance from the piston, and the changes in density, pressure, and temperature became less extensive than those immediately behind the piston. In front of the piston, the air was set in motion by the motion of the piston; behind the piston, the air moved by reason of its natural tendency to expand into the space freed by the piston.

There exists another method of setting the air in motion. Let us use a tunnel with a partition. At the right of the partition the pressure is low, while it is higher at the left. When the partition is removed suddenly, the right and the left portions of the air will be separated by a pressure discontinuity which will start the motion at once, as if it was created by the movement of the piston. The discontinuity will move to the right at a velocity determined by the pressure ratio. The air in the right part of the tunnel will be compressed and will begin to move; the air in the left part will also be moving, but its pressure will decrease gradually and will weaken the shock wave.

Thus, there exist three sources of air movement: the movement created by the

piston (wall); the movement created by the tendency for expansion; and the movement created by the compensation in pressures.

Suppose that we have a tank supplied with water through a small tube (nozzle), which is closed at this moment; outside the tank the air pressure is equal to p_1 , while the water pressure in the tank p_0 is somewhat higher (Fig.9), causing a drop in pressure $p_0 - p_1$. If the nozzle is opened, the layer of water at the nozzle will be discharged, causing waves of decreased pressure to be produced inside the tank, which created negative pressure in the tank. The flow of water discharged from the nozzle will stop if the weight of the water is disregarded. Although water possesses some tension, it has not the capacity for unlimited expansion like a gas.

To make water flow continuously, it must be supplied to the tank without interruption by a pump or by gravity. The velocity of efflux can be determined by the following method: Let m_s be the mass of water discharged in one second, which is equal to the density ρ multiplied by the volume Q of water discharged per second. The volume is equal to the product of the cross-sectional area of the stream F and the velocity of flow V . Then, we will have:

$$m_s = \rho Q = \rho FV$$

The delivery of the pump per second is equal to the pressure at which it supplies water to the tank, i.e., p_0 multiplied by the volume of water in one second which, in turn, is equal to the discharged volume Q . The pressure outside the tank counteracts the outflow, with the counteracting work being equal to the pressure p_1 multiplied by the discharged volume Q . The difference between the work of ejection and counteraction is used for imparting a velocity V to the mass m_s , i.e., a kinetic energy of $m_s \frac{V^2}{2}$.

Writing this condition in the form of an equation gives Bernoulli's equation for a fluid in motion and the formula for the velocity of discharge.

$$(p_0 - p_1) Q = m_s \frac{V^2}{2}; \quad \frac{m_s}{Q} = \rho; \quad \rho \frac{V^2}{2} = p_0 - p_1;$$

$$V = \sqrt{\frac{2}{\rho} (p_0 - p_1)}$$

Let the tank contain not water but air. What will be the difference in air efflux when the difference in pressures is $p_o - p_1$? This question is more complicated than in the case of a fluid. Assume that, during one second, a mass of air m_s is discharged. Inside the tank, where the pressure is p_o , this mass has a volume $Q_o = \frac{m_s}{\rho_o}$; after discharge at a pressure of p_1 , the volume of this mass will be equal

to $Q_1 = \frac{m_s}{\rho_1}$. Assuming that the discharge is accompanied by an adiabatic expansion, the following correlation between volume and pressure is obtained:

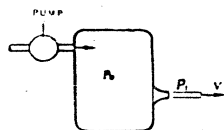


Fig. 9 - Schematic Diagram of Fluid and Gas Discharge

$$\frac{p_o}{p_1} = \left(\frac{Q_1}{Q_o} \right)^{\gamma} = \left(\frac{Q_1}{Q_o} \right)^{1.4}$$

To determine the velocity of air discharge, the work required for generating the kinetic energy must be computed. The first work is that of expulsion, whose value does not differ from the value of the work done in discharging the water

$$E_{\text{disch.}} = p_o Q_o = m_s \frac{p_o}{\rho_o}$$

The work of counteracting the discharge will then be

$$E_{\text{count.}} = -p_1 Q_1 = -m_s \frac{p_1}{\rho_1}$$

It is evident that this work is greater than the work of water outflow, because of the increased volume. Thus, the difference in the work of expulsion and that of counteraction in the case of air discharge is less than in the case of water. However, we cannot conclude from this that the velocity of discharge is lower. The fact is that, in the process of discharge, the mass m_s of air will expand and by that will produce an additional amount of energy, which will be used for the increase in the velocity of discharge.

Let us determine the work of expansion. In the process of expansion, the pressure decreases while the volume increases correspondingly to the expression $pQ^\chi = p_0 Q_0^\chi$. This expression can be represented in the form of a diagram (Fig.10). The work of expansion will be presented by the cross-hatched area and can be determined by integrating the expression $dE = pdQ$. As the result of integration we have:

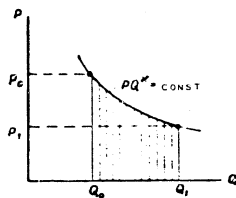


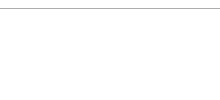
Fig.10 - Pressure as a Function of Volume, at Adiabatic Expansion

$$E_p = \frac{1}{\chi - 1} (p_0 Q_0 - p Q) = \frac{m}{\chi - 1} \left(\frac{p_0}{\rho_0} - \frac{p}{\rho} \right)$$

The work of expansion can also be determined by a different method, taking into account the kinetic theory of gases.

This is of some interest for understanding the nature of the phenomena, and therefore we shall examine it more carefully. According to the kinetic theory of gases, a gas consists of freely and chaotically moving molecules, whose only interaction is that of collision. Each air molecule can be imagined as consisting of two spheres - atoms of oxygen and nitrogen connected with each other. Such a molecule has five degrees of freedom of movement: Three movements in three mutually perpendicular directions and two rotations about the axis perpendicular to the line connecting the atoms (Fig.11). Two more movements are possible: revolving about the line connecting the atoms and vibrating in the space between the atoms. However, these movements possess a comparatively low energy and will be disregarded here.

It appears that in the process of random collision, the average energies for all five stages of freedom are equal. The energy of the three forward motions of molecules in three mutually perpendicular directions, contained in a unit of mass, can be represented as $\frac{1}{2} v_M^2$, where v_M is the average molecular velocity. Then, the entire energy of the internal movement for all five degrees of freedom will be



$E_{int} = \frac{5}{6} V_M^2$. The average molecular velocity is correlated with the pressure on the walls and can be represented by $V_M^2 = 3 \frac{p}{\rho}$ or by the temperature $V_M = 29.4 \sqrt{T}$.

If, as a result of the expansion, all of the gas (air) was set in motion, then the energy of motion will be taken from the internal energy, which will be decreased correspondingly. This condition can be expressed as follows:

$$\Delta E_{int.} = \frac{5}{6} V_{M.o}^2 = \frac{5}{6} V_M^2$$

Here $V_{M.o}$ = average molecular velocity before the expansion.

V_M = average molecular velocity after expansion.

From this it follows that, as a result of the expansion, the temperature of the gas will be decreased. Substituting $V_{M.o}^2 = 3 \frac{p_o}{\rho_o}$ and $V_M^2 = 3 \frac{p}{\rho}$ will yield

$$\Delta E_{int.} = \frac{5}{2} \left(\frac{p_o}{\rho_o} - \frac{p}{\rho} \right) = \frac{1}{\gamma - 1} \left(\frac{p_o}{\rho_o} - \frac{p}{\rho} \right) = E_p$$

By adding the energy of expulsion, counteraction, and expansion, we obtain the energy of motion. This will lead to Bernoulli's equation for air and the expression for the discharge velocity:

$$\frac{V^2}{2} = E_{disch.} + E_{count.} + E_p = \frac{p_o}{\rho_o} - \frac{p}{\rho} + \frac{1}{\gamma - 1} \left(\frac{p_o}{\rho_o} - \frac{p}{\rho} \right) = \frac{\gamma}{\gamma - 1} \left(\frac{p_o}{\rho_o} - \frac{p}{\rho} \right)$$

$$V = \sqrt{2 \frac{\gamma}{\gamma - 1} \left(\frac{p_o}{\rho_o} - \frac{p}{\rho} \right)} = \sqrt{7 \left(\frac{p_o}{\rho_o} - \frac{p}{\rho} \right)} ; \frac{\gamma}{\gamma - 1} = 3.5$$

The ratio $\frac{p_o}{\rho_o}$ can be substituted by $288T_o$ and the ratio of densities $\frac{\rho_o}{\rho}$ by the ratio of compressions $\frac{\rho_o}{\rho} = \left(\frac{p_o}{p} \right)^{\frac{1}{\gamma}}$; then the velocity of discharge will have the form:

$$V = \sqrt{2000T_o \left[1 - \left(\frac{p}{p_o} \right)^{1-\frac{1}{\gamma}} \right]} = V_o \sqrt{1 - \left(\frac{p}{p_o} \right)^{0.285}}$$

If the outflow occurs in a vacuum, i.e., if $p = 0$, the velocity of discharge will be $V = V_0 = 45\sqrt{T_0}$; at the initial temperature $t = 15^\circ$ or $T_0 = 288^\circ$, $V_0 = 760$ m/sec.

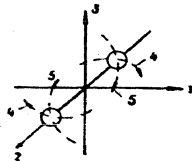


Fig. 11 - Schematic Diagram of Possible Motion of Air Molecules

However, it should be mentioned that, if the ratio of pressures is low, the cooling during the discharge process is so high that the air will contract. To compute the velocity of discharge, a graph is used (Fig. 12). Knowing pressure ratio $\frac{p}{p_0}$ and using, from the graph, $\frac{V}{V_0}$, we can determine V .

Diagrams for the change in density and temperature by adiabatic expansion are shown in Fig. 12. Let us remember that T_0 is the temperature of the air before the discharge by the initial pressure p_0 . From the expression of the velocity of outflow supersonic velocities can be calculated. However, to obtain a supersonic flow in a required di-

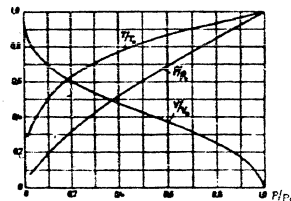


Fig. 12 - Velocity, Density, and Temperature as a Function of the Pressure Variation during Air Discharge

rection, it is necessary to have not only a certain pressure ratio but also a nozzle design of a certain shape. This point will be analyzed in the next article.

(To be continued)

CREATIVE ADVANCEMENT OF INVENTORS AND INNOVATORS

Eng. Colonel V. Aleksandrov

In our units, a large group of rationalizers and inventors, true innovators, is at work whose technical aim is to facilitate the work of technical personnel, to develop ways and methods of serving aviation technique. By skillful direction and



Fig. 1 - Mechanized Welding Table



Fig. 2 - Mechanized Riveting Table

proper support of the activity of efficiency experts and inventors, the engineer of a subdivision promotes the successful solution of actual organization problems in the work of technical personnel. For example, in the unit where officer V.D. Pres-nukhin is an engineer, efficiency men and inventors improve the equipment of the

work places for automatic work. The application of their suggestions considerably increased the efficiency of specialists.

Officer A.P. Pogrebnyak had shown himself an active efficiency expert. He had introduced several suggestions, most of which had been realized. For example, on his suggestion a special welding stand was constructed (Fig.1) with a rotating device a and a clamp mechanism b which can be moved up or down. A bracket for a gas burner is mounted to the table. By means of such a mechanized table, one welder can weld various parts in a short time.

Officer A.P. Pogrebnyak had suggested a very convenient device for riveting cowlings and for tin work (Fig.2). The riveting table is constructed of two plane screw jacks (from scrap). The pivot 1 used as support while riveting; a sheet iron table 3 is mounted to the second pivot 2. The pivot and table can be moved up or down independently, by means of the worms. This device is known as "mechanized riveting table" and can be used by one operator without help. Particularly, the table is useful for riveting of cowlings of any shape.

Besides these devices, officer A.P. Pogrebnyak invented many other devices for which he was rewarded with valuable prizes and bonuses.

There are many examples of the useful work of efficiency experts and inventors. For example, to reduce stalling of airplanes during overhaul work, rationalizers and inventors have suggested numerous devices and mechanisms and thus contributed to the more rapid completion of assignments and to greater production efficiency. One suggestion was for special mobile warming huts. Such huts are built of rectangular blocks (or logs). Fiber packing or moss is used as the intermediate layer between the blocks, roofs are covered with tar paper or with homemade laths. The heating system is of the stove-type. Such huts are mounted on runners and can be moved any place.

As experience shows, the control and calibrating instruments in the warming huts are well protected, especially if the sheet-iron stoves of temporary types are faced with brick (stone). Such stoves retain heat for a long time. The personnel

usually works inside these huts in summer overalls without overcoats, which is very comfortable. It is possible to work in these huts, not only during the daytime but also at night, by limited light.

In the unit where officer V.D.Presnukhin is an engineer, such warming huts can accommodate a fuselage and tail assembly of the airplane MIG-15, although the

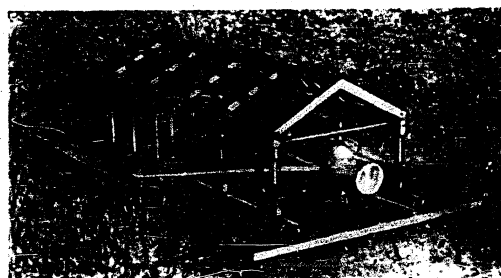


Fig.3 - Model of a Warming Hut

larger part of the wings remains outside (four front posts of the huts are hinged and removable; see Fig.3). The front part of the hut and the spot where the wings protrude are covered with canvas after the airplane is under the roof. The canvas is provided with sewn-in shock absorber cords, for better fit over the profile of the wing. The side walls and the roof of the hut are covered with shingles (lath).

Such a hut can accommodate several rows of shelving for removable airplane parts and work benches with vises. For its construction six times less material is required than for covering the entire airplane; in addition, it is convenient for overhaul work in any weather.

Warming huts are usually erected near airfields doing overhaul work. As a rule, a conveniently located caponier will be selected for this purpose, with a field for engine testing located close by.

A caponier accommodates a wooden or concrete platform or scaffold and shelving for removable units and airplane parts, special places for ground-testing instru-

ments, and a mounted stand with fire-fighting equipment. Wooden shelves can be used together with the work benches for checking and repairing the equipment and for standard overhaul work. To protect them from rust and deposits they are furnished with attached covers. Each carries a tag that indicates the parts to be repaired and name of the mechanic assigned to it. The stands are provided with cut-outs for accommodating aircraft parts, covered with felt or sponge rubber to protect the surface of the parts from dents and scratches. Since the removable parts of the airplane are stored in a special order, the technical personnel can rapidly and accurately remove and install cowlings, trap doors, and lanterns. Possible mix-ups created by the exchange of cowlings while working on two or more airplanes, can thus be prevented.

A well-arranged and smooth platform, as proved in practice, is very important for preventing damage to the inner covering and hinge fittings of an airplane during regular overhauls. Before such platforms or scaffolds were developed, much effort and time was spent on installing plugs into the jackets without damaging the extension pipe or the piping system. Now these jobs are simplified. Much work was done by these efficiency experts in improving these platforms. For example, officer N.V. Likhachev suggested installing the platform on guide rails, which would considerably simplify the butt welding of the tail part of the fuselage. To make it possible for several mechanics to work simultaneously, the efficiency men suggested placing a special wooden sidewalk with a soft pad instead of a cloth on the wings, to prevent scratching of the wing surface.

Special cases with compartments painted in red, are used for the storage of tools. The cases are of the double-folding type, similar to a suitcase. During transportation, the tools are fastened in these compartments by special locks. In the airplane the cases are placed at certain points, on special supports constituting a folding base.

Besides the group type of cases the unit uses individual tool chests for special operations (dismounting and mounting of landing aids, armament, hydraulic

boosters, etc.). Each case contains special enclosed compartments for splints, liners, insulating tape, and testing wire). These cases are fitted with a series of new devices constructed on suggestion of experts.

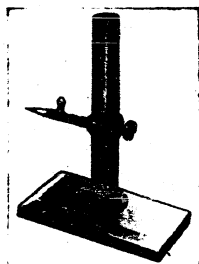


Fig. 4 - A Device for Measuring Clearances in the Assembly of a Landing Gear

Similar to the tool chests, special cases are constructed with compartment for plugs of various size pipes used in heating, hydraulic, and air systems and also for switch joints. Such plugs are made of duralumin, painted red, and numbered; this permits immediate location of the plugs, their installation into the proper space, and checking whether all had been removed from the airplane. The use of plugs helps in preventing breakdown of the hydraulic booster, clogging of the atomizers, or burn-through of pipes.

Several more suggestions of our efficiency experts deserve attention. For example, a mobile vat for washing removable armament parts or other airplane accessories is convenient. A wooden grill is placed on the bottom of the vat to prevent damage to the parts. Dirt from the parts collects under the grill. A drain cock is installed in the bottom of the vat. The vat is also useful for washing covers, disassembled units, links, and cartridges.

A highly simplified device, shown in Fig. 4, permits measuring clearances in the mounting of landing gears with required accuracy. Previously, these clearances were measured by eye, and often the data used by the airplane technician, unit technician, and engineer differed.

These are some of the suggestions by the efficiency experts, that were realized in our subdivisions.

To improve the quality of aircraft overhaul service, the extensive experience of the efficiency experts and inventors should be used more fully.

A creative attitude in work results in more rational methods of improving and

expediting the preparation of airplanes for flights.

A NEW METHOD OF REMOVING DENTS IN THE AIRPLANES COVERINGS

by

Engineer Major V. Gorokhov and
Major of Technical Services S. Khar'kovskiy

At the modern high flying speeds, the condition of the airplane covering plays a very important role. The presence of various roughnesses in the form of dents or hollows leads to a decrease in flying efficiency of an airplane. To remove these, it usually becomes necessary to open the covering or to cut auxiliary hatches, which requires considerable time and work.

In our unit, a new method of removing dents has been developed that is considerably cheaper, simpler, and more efficient than the old methods. Its basic advantage consists in the possibility of eliminating unevennesses in hard-to-reach places of the airplane covering.

The principle of this method consists in filling in the hollows in the covering with a special paste V-77, which comprises 30 parts by weight of varnish PMA (20% solution), 14 parts product MGF-9, one part benzoyl peroxide, 36 parts Portland cement brand 400 and 4.5 parts wood flour.

To prepare the paste V-77, product MGF-9 is added to the varnish PMA, and the resultant composition is mixed with a spatula for 2-3 min. Then, benzoyl peroxide is added, and the intermixing is continued for 5-6 min after which the cement and wood flour are added. To obtain a homogeneous mass, the entire mixture must be carefully mixed for 12-15 min. The useful life of the paste V-77, from the time of

its preparation, is 3-5 hrs at a temperature of 20-25°C and 24 hrs at a temperature below 0°C. It is recommended to prepare the paste indoors, and to take it to the place of work in a hermetically sealed glass, porcelain, or metal container.

Before applying the paste, the surface of the dented covering is carefully cleaned of dirt. The varnish-paint coating is removed by a scraper or polishing cloth №60-80 from the entire surface to be treated. Then, the entire cleaned space is rubbed with a cotton tampon soaked in acetone, and dried with a clean rag.

The paste is applied with a wooden or metal spatula in layers of 1.5-2 mm, building them up to the required profile with a slight allowance for shrinkage (not more than 1%) and the necessary trimming. The paste is applied under a certain pressure to avoid the formation of blow holes. Each layer is dried with hot air

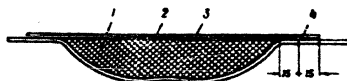


Fig.1 - Preparation of the Filled-In Hollow for Final Drying
1- paste 2- Cellophane layer 3- Paper cover 4- Layer of dextrine glue

(75-80°C) for 8-10 min. The drying is carried out carefully, avoiding any swelling of the paste. When swelling occurs, the stream of hot air is temporarily deflected to the side and the surface is leveled with a scraper. If a smooth surface is desired, it is recommended to apply the last layer of paste with a spatula dipped in acetone. After this, the paste is dried with hot air (85-90°C) from a pre-heating MP-44 oven for 20-30 min.

The dried surface is covered with a cellophane film so as to cover the paste over the entire perimeter of 10-15 mm; this is covered with heavy paper spread over the entire cellophane layer of 10-15 mm (Fig.1). The paper cover is cemented to the airplane covering with dextrine glue in such a way as to avoid contact between glue and paste. After the repaired space is glued over, the final drying of the paste

begins. The process of drying for various seasons of the year is given in Table 1.

After drying is completed, the paste must be cooled to the temperature of the surrounding air, after which the paper and cellophane coverings are removed. The

Table 1

Drying Stages	Sequence of Drying the Paste			
	In Summer		In Winter	
	Temperature of Supplied Air °C	Application Time min	Temperature of Supplied Air °C	Application Time min
Each intermediate layer	75 - 80	8 - 10	75 - 80	12 - 15
After application of the last coat	85 - 90	25 - 30	85 - 90	40 - 45
Final drying after cementing the paste (one of the processes)	1) 120	60	120	90
	2) 100	90	100	120
	3) 90	120	90	180

surface of the paste is given the required form and smoothness with emery paper or a file. The shreds of paper, glued to the covering, are removed with a damp rag, and the repaired place is given a coat of varnish.

The endurance tests were run on samples and directly on the airplane. To check the properties of the paste on samples, vibration tests were made, and tests were

run on determining the adhesion of the paste to metal, its water-repellent properties, the effect of alternating temperatures of $\pm 60^\circ\text{C}$, and its corrosion resistance.

For the vibration test, specimens of 2 mm thickness of duralumin were prepared (Fig. 2). The specimens were tested for

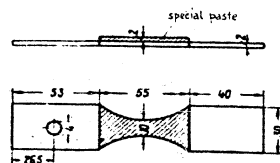


Fig. 2 - A Specimen for Vibration Tests bending at a symmetric load cycle. The paste adhered to the specimens even if these were destroyed; there were several

cases in which the metal disintegrated while the layer of paste remained unbroken (Fig.3). To test the corrosion resistance, the specimens were placed in a corrosion chamber at 98-100% humidity for two months. Before the experiment, the specimens were cleaned of the oxide layer and covered with paste V-77. After the tests were concluded, no corrosion cracks were discovered on the surfaces of the specimens.

To determine the effect of fluctuating temperature, the specimens were transferred eight times from the thermostat set to a temperature of 60°C , to a cold chamber set to a temperature of -60°C . The samples were kept under these temperatures for 3 hrs. After the test, there were no cracks or detachment of the paste from the metal. The strength of the bond between paste and metal had not decreased.

The water resistance of the specimens was tested by keeping them in water for 72 hrs. The weight was taken before and after the test and showed an increase in weight by 2%.

Tensile tests showed that (Fig.4) the adhesion of the paste to a given material

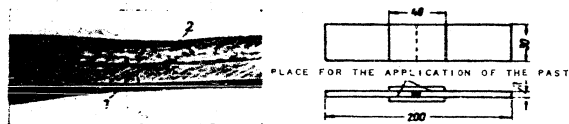


Fig.3 - Disintegration of the Specimen in Vibration Tests
1- Duralumin 2- Paste

Fig.4 - Specimen for Tensile Testing

fluctuates within limits of $30.8-75.0 \text{ kg/cm}^2$, giving an average (for 10 specimens) of 50.4 kg/cm^2 .

Later the paste was tested in airplanes. For this purpose, 18 dents in a suspended metal kerosene tank were repaired. Two dents of $70 \times 40 \times 6 \text{ mm}$ in the bottom part of the fuselage, between bulkheads 17 and 18, one of $70 \times 35 \times 6 \text{ mm}$ at the

front of the spinner, one of $50 \times 40 \times 8$ mm on the leading rib of the right wing root and one of $130 \times 70 \times 12$ mm in the bottom part of the fuselage between the bulkheads 9 and 10. The depressions were filled directly on the airfield at an air temperature of $8-10^{\circ}\text{C}$. Airplanes, whose skin had been repaired with paste V-77, flew 60-70 hrs in winter and summer and made 150-170 landings each. The inspection of the repaired places showed no places of detachment, disintegration, or cracking of the paste.

This proves that use of the paste V-77 considerably simplifies the technology of repairing dents in airplane covering, especially in hard to reach places, and improves the efficiency of the work while preserving the high quality of the repair work in general.

READERS SUGGEST

ASTRONOMIC COMPUTATIONS FOR NIGHT FLIGHTS

To simplify the work of the navigator in determining the astronomic lines of position and fixing the latitude of the flight, officer N.F. Khavkin suggests the use of a Table of precalculated notations of star time (S) and corrections for the calculated distance to Polaris ($\Delta\phi_{\text{pol.}}$) during the night flights.

Use of the Table eliminates the necessity of using the astronomic annual publication (AAE) during the flight, permits rapid finding of the requested magnitude of star time corresponding to altitude and azimuth of the calculated star, and also gives the possibility of determining with greater accuracy which stars (or paired with Polaris) should be used in fixing the position of an airplane.

The preparation of such a Table, even for a flight of long duration, takes no more than 10-15 min. To enter the star time notations and to obtain corrections for the calculated distance to the North Star, it is necessary only to compute the star time ($S_1 = 130^\circ$). All other magnitudes of star time and corrections are introduced without any calculations. Each subsequent magnitude of star time differs from the preceding one, vertically and horizontally, by 1° and 5° respectively.

The longitude of the flight is recorded on the left side of the Table with the 1° interval and is expressed in whole numbers. The local time with an interval of 20 min is marked in the upper horizontal column, and determines the change in star time, from left to right by 5° successively.

The lower horizontal column of corrections for the Table longitude ($\Delta\lambda$) gives the over-all corrections, consisting of a constant correction for all longitudes

(in the Table: - 4') and of a correction for the change in minutes of star time with each subsequent hour of flight.

Since a time minute is equal to 15 arc minutes, we have a possibility, when calculating the first notation of star time, to mark on the Table such a moment in the local time (19 hours, 15 minutes) which would bring the notation of the latitudinal minutes to the minimum possible negative magnitude. In this way, the average correction in minutes for the Table longitude ($\Delta\lambda$), shown for every hour of flight, will be equal to a small negative magnitude, easily computed by tracing the longitude of the calculated point on a map.

To every notation of star time corresponds a definite correction for the computed distance to the North Star ($S_1 = 130^\circ$, $\Delta\varphi_{pol.} = + 13'$), independent of the latitude of the flight. Thus, the Table, under each notation of star time (in the denominator) gives a corresponding correction $\Delta\varphi_{pol.}$ which is selected from TVAZ.

This is how to use the Table: A pair of stars or a star together with the North Star are selected before fixing the position of the airplane by two ALP with the help of the Table.

For this purpose, it suffices to locate in the Table the approximate local time and longitude of flight and from their intersection determine the star time S , from which the suitable stars can be selected. For example, $T_{local} = 23$ hours, 20 minutes, $\lambda = 35^\circ$. We find that $S = 183$, and with the help of TVAZ we conclude that Vega and Arcturus are more convenient for the computation.

To find the height and azimuth of the computed stars in the Table, a notation of star time is chosen at the intersection of the longitude and local time prescribed by the navigator, which deviates from the moment of computation toward the diminishing side. Thus, to determine the ALP, the star time S is not computed but is taken directly from the Table.

If the longitude of the flight is close to 37° , and the distance to the star is equal to 23 hours, 26 minutes, 12 seconds, then the star time will be $S = 185^\circ$. In the column of local time, a value of 23 hrs, 19 min is shown, which differs from

Table of Precalculated Notations for S and $\Delta\varphi_{pol.}$ for the Night of 15-16 April 1954

T_{local}		19.59	20.19	20.39	20.59	21.19	21.39	21.59	22.19	22.39	22.59	23.19	23.39	23.59	00.19	00.39	00.59	01.19	01.39
λ Longitude																			
32°	S	130°	135°	140°	145°	150°	155°	160°	165°	170°	175°	180°	185°	190°	195°	200°	205°	210°	215°
	$\Delta\varphi_{pol.}$	+ 13'	+ 18'	+ 23'	+ 28'	+ 32'	+ 36'	+ 40'	+ 43'	+ 47'	+ 49'	+ 52'	+ 54'	+ 56'	+ 57'	+ 58'	+ 58'	+ 58'	+ 58'
33°	S	131°	136°	141°	146°	151°	156°	161°	166°	171°	176°	181°	186°	191°	196°	201°	206°	211°	216°
	$\Delta\varphi_{pol.}$	+ 14'	+ 19'	+ 24'	+ 28'	+ 33'	+ 37'	+ 41'	+ 44'	+ 47'	+ 50'	+ 52'	+ 54'	+ 56'	+ 57'	+ 58'	+ 58'	+ 58'	+ 58'
34°	S	132°	137°	142°	147°	152°	157°	162°	167°	172°	177°	182°	187°	192°	197°	202°	207°	212°	217°
	$\Delta\varphi_{pol.}$	+ 15'	+ 20'	+ 25'	+ 29'	+ 34'	+ 38'	+ 41'	+ 45'	+ 48'	+ 50'	+ 53'	+ 55'	+ 56'	+ 57'	+ 58'	+ 58'	+ 58'	+ 57'
35°	S	133°	138°	143°	148°	153°	158°	163°	168°	173°	178°	183°	188°	193°	198°	203°	208°	213°	218°
	$\Delta\varphi_{pol.}$	+ 16'	+ 21'	+ 26'	+ 30'	+ 34'	+ 38'	+ 42'	+ 45'	+ 48'	+ 51'	+ 53'	+ 55'	+ 56'	+ 58'	+ 58'	+ 58'	+ 58'	+ 57'
36°	S	134°	139°	144°	149°	154°	159°	164°	169°	174°	179°	184°	189°	194°	199°	204°	209°	214°	219°
	$\Delta\varphi_{pol.}$	+ 17'	+ 22'	+ 27'	+ 31'	+ 35'	+ 39'	+ 43'	+ 46'	+ 49'	+ 51'	+ 54'	+ 55'	+ 57'	+ 58'	+ 58'	+ 58'	+ 58'	+ 57'
37°	S	135°	140°	145°	150°	155°	160°	165°	170°	175°	180°	185°	190°	195°	200°	205°	210°	215°	220°
	$\Delta\varphi_{pol.}$	+ 18'	+ 23'	+ 28'	+ 32'	+ 36'	+ 40'	+ 43'	+ 47'	+ 49'	+ 52'	+ 54'	+ 56'	+ 57'	+ 58'	+ 58'	+ 58'	+ 58'	+ 57'
Correction for longitude		$\Delta\lambda$		-4'		-6'		-9'		-11'		-14'		-16'					

the moment of computing toward the lesser side and is nearest to it.

The magnitude of non-coincidence (7 min, 12 sec = $1^{\circ}48'$) of the moment of computation with the one shown in the Table, added to the correction $\Delta\lambda$ ($1^{\circ}48' + 11' = 1^{\circ}59'$) shows how much the latitude (37°), taken from the Table, should be shifted toward the West. The new latitude is not computed but is traced on the map by shifting the Table longitude toward the West, at the magnitude of non-coincidence of the moment of computation with the one shown in the Table and with the constant correction for every hour of flight $\Delta\lambda$. In our example, where $\lambda = 37^{\circ}$, $T_{corr.} = 23$ hrs, 26 min, 12 sec, the new longitude, i.e., the longitude of the computed point will be equal to $37^{\circ} - 1^{\circ}59' = 35^{\circ}1'$.

To determine the latitude φ of the airplane position, it is sufficient to compute the distance to the Polaris and add to it algebraically the correction $\Delta\varphi_{pol.}$ shown in the Table, subtract the correction for refraction r and introduce the correction for sextant.

The correction $\Delta\varphi_{pol.}$ is taken from the Table by simple interpolation, if the moment of computation does not coincide with the one shown in the Table.

Using the Table, a navigator can continuously control the latitudinal position of the airplane ($\varphi = h_{pol.} + (\pm\Delta\varphi_{pol.}) + (\pm C) - r$), thus considerably simplifying the work.

HYDRAULIC PRESS FOR TESTING "ShGM" FLEXIBLE HOSE

The flexible hose "ShGM", which is part of the airplane hydraulic system, requires frequent replacement. Often such replacement operation is impossible in many airplanes. Sometimes, for this purpose, spare hose are selected from sets of still serviceable hose whose service life guarantee has expired. In both cases, a check-up on their serviceability is required.

A reader of the journal, officer I.G. Potapov, reported that, in their unit, a hydraulic press for testing up to 10 hose sections simultaneously has been constructed (see photo).

The hydraulic press consists of the following parts: power frame 1, cylinder

for retraction and lowering of landing gear 2, power screw 3, body of the junction box with ball valve and hydraulic tank 4, manometers 5 for 400 kg/cm² and for 150 kg/cm², collector 6 with a connecting pipe for attachment of the hose sections 10, connecting coupling 7, and a guard 8. The power frame is made of two U - shaped section irons connected by cross bars, with the upper bar serving as a support for the hydraulic cylinder, and the second as a nut for the worm screw. The partitions are attached to the U-sections by means of bolts. A vertical box attached to the hydraulic tank by means of collars is mounted on a power frame. The balls in the cylinder of retraction and extension of the landing gear are removed from the piston grooves, forming a ball lock and preventing a locking of the piston when the piston rod is at the forward position 9.



Hydraulic Press for Testing Flexible Hose

The power cylinder is connected to the cross bar by a base plate with a collar, to which a guard 8 is mounted. The movement of the cylinder in vertical position about the rear support is limited by the cylinder cams, while movement in horizontal direction (to the left or right) is possible along the support.

The test of the "ShGM" hose is conducted by two skilled mechanics, one of whom regulates and maintains the prescribed pressure while the other checks the

condition of the hose.

The hose sections are attached to the connecting pipe of the collectors and their other end is closed by plugs. The hydraulic tank is filled with an alcohol-glycerol mixture to the rim of the upper cover. Then the hose sections are filled with the alcohol-glycerol mixture under a pressure of 100-120 kg/cm². The required pressure is created by turning of the power screw, as specified in Technical Orders for hose testing, taking the particular type of hose into consideration. This pressure is maintained for 5-10 min and, during which time the external condition of the hose sections and the nozzle fit are simultaneously checked. The presence of one or two leaking sections will cause a slow pressure decrease in the system. In this case, it is preferable to finish testing the sections which are in good order, not detaching the defective ones and maintaining the required pressure by rotating the power screw. If the hose sections are in good order and completely tight, there will be no leakage, and the pressure will stay constant all the time, without having to adjust the power screw.

After completion of the pressure test, the power screw is released causing the pressure to drop to 100-120 kg/cm²; then, the valve of the air bottle 11 is closed and the pressure is reduced to zero over the air valve 12.

After that, the tested hose sections are dismantled and the alcohol-glycerol mixture drained into covered containers. Later, the second group of hose sections is connected, the air valve closed, and the operation repeated.

The hose sections in which the leakage or exudation of the fluid was detected at points of contact with the nozzles are declared unfit for further use and are marked as unrepairable.

The amount of alcohol-glycerol mixture in the hydraulic tank is sufficient for testing a total of thirty hose sections (i.e. three operations), after which time the tank is refilled with the alcohol-glycerol mixture. The drained mixture can be re-used on the condition of careful filtering to prevent clogging of the press system by mechanical particles.

The hydraulic press is easy to construct in field repair shops from parts and pipe systems of the airplane hydraulic systems.

A REPAIR STAND FOR FUEL PUMPS

In the regular operation of jet aircraft, it frequently becomes necessary to repair and check airplane fuel pumps in field workshops. In the subdivisions where

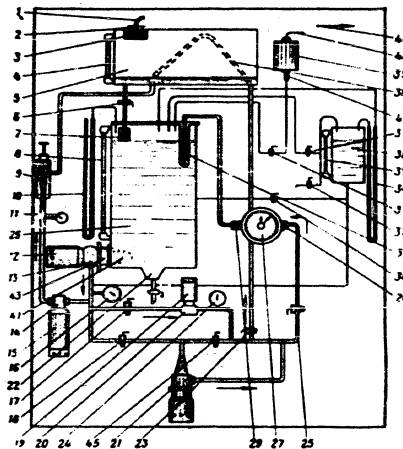


Fig. 1 - Basic Diagram of the Test Stand

1- Drainage pipes; 2- Nipple with plug; 3, 7 and 33- Filters; 4, 8, 35- Gages; 5, 26- Upper and main tanks; 6, 17, 18, 23, 25, 30, 31, 32 and 37- Valves; 9- Needle valve; 10- Pressure gage; 11, 16, 24- Manometers; 12- Electric motors of the MBP-3 type; 13, 14, 20 and 21- Pumps; 15, 19- Electric motors; 22- Settling tank and drain cock; 27- Disk-type fuel gage of the DB-40 type; 34- Pressure gage; 36- Mercury tank; 38- Fuel intake pipe; 39- Reservoir; 40- Outlet to vacuum pump; 41- Collector PN-45I type; 42- Connecting pipe; 43- Flange for attachment; 44- Direction of fuel flow; 45- Stop cock for hydraulic tests; 28- Inlet; 29- Outlet of the DB-40 type

Z. Feoktistov and L. Sergeyev are officers, special stands for complete check-up of

fuel pumps are used.

The operating principle of the stand is very simple. Any aircraft mechanic, familiar with the operation of airplane fuel pumps, can test them easily on this stand. The stand permits testing the pumps as an integral unit or as separate parts. If one of the parts is missing the fuel lines are closed by valves.

A description of the design of such a stand (Fig.1) is given below: The body of the stand is welded from angle irons. The front and horizontal panels are made of 3 mm Duralumin plates. On the right side of the horizontal panel, a bracket for the pumps to be tested is mounted. The uprights and three sides of the upper part of the frame are made of 1.2 mm Duralumin. All welding seams are carefully trimmed, filled with putty and, after drying, smoothed with sand paper.

The frame of the stand is provided with four compartments for housing kerosene tanks, electric wiring, and manifolds. On the front panel, left, are mounted control instruments, switches, and valves for the air lines. A disk-type fuel gage 27 is mounted to the bottom part of the panel whose internal section accommodates instruments, electric lines, and air lines for the piezometers. A mercury tank 36 and a receiver from the vacuum pump 39 are mounted on the right side. Two pressure gages are installed on additional panels.

The gage of the mercury tank, connected with it by pipes of not less than 4 mm diameter, is located on the left side of the panel. At the right, inside the frame, the main kerosene tank of 126 liter capacity is installed. Its gage is outside the panel, on the right side. An additional kerosene tank of 150 liter capacity is located in the upper part of the frame.

The lower part of the frame contains the pipe systems, valves (five), and an additional pump 21 on the floor of the stand. Between the upper kerosene tank 5 and the lower tank 26 a valve 6 is mounted to the frame. The operating levers for the valves and the platform for mounting the pump to be tested are located outside the panel.

An outlet for a nipple with a flange coupling 43 for connecting the pumps is

installed in the right lower corner of the front wall of the kerosene tank 26. Two round welded-on plates of 50 mm and 25 mm thickness, with threaded nipples for the connecting pipes (bends) of the measuring glass 8 are mounted vertically along the right side of the front surface.

A settling tank 22 with a drain cock is welded to the lower part of the tank. To the back wall and the upper surface of the tank are welded several plates of

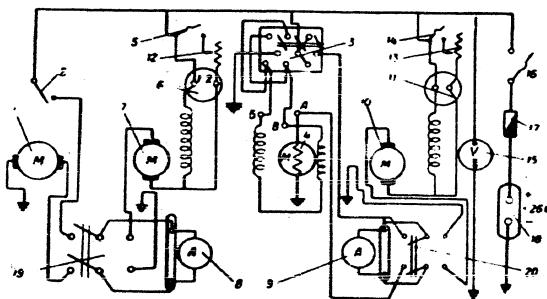


Fig. 2 - Basic Wiring Diagram

1- Electric motor D-150; 2, 5, 14, 16- Switches PP-45; 4- Electric motor D-200; 6, 11- Fish-plate for electric motor; 7, 10- Electric motor MBP-3; 8, 9- Ammeters of 50 amp, MK-55; 12, 13- Rheostat RBP-45; 15- Voltmeter; 17- Meltable 40-amp inertia fuse; 18- Receptacle; 19, 20, 3- Switches 3PPN-45

55 and 25 mm thickness with threaded nipples for the connecting pipes. Into the upper surface of the tank, an aluminum flange is welded, carrying eight studs for fastening the cover of the vent with the filter 33 and an inlet pipe.

The main tank 26 (300 x 600 x 700 mm) is made of AMTsP alloy and is mounted on the platform of the frame.

The upper kerosene tank 5 of 150 liter capacity can be made from any material. The tank has a priming vent and a gage on the front side. The size of the tank 5 is equal to the size of the upper part of the frame. A drain pipe with a cock 6 is

welded into the tank and enters it 25-30 mm from the edge.

The pipe lines, required for the testing procedure are made of seamless pipes with an inside diameter of 32 mm. The ends of the pipes must be flanged for connection with the durometer. The entire system of pipe lines is connected with the durometer and attached with circlips.

The pipes leading from the pump to the needle valve 9 and from the valve to the tank, are made of steel with an inside diameter of 8mm.

The body on the needle valve 9 is made of brass and the stop valve of steel, while the cone of the needle is so designed that the needle can open the cross section completely or close the entrance into the tank. This gives a possibility of determining the maximum efficiency of the pump on the basis of the pressure created. For determining the pressure, manometers with a scale graduated up to 6 atmospheres are used.

The disk-type fuel gage 27 is similar to the one used in filling stations and is rated for the main fuel tank 26. The valves 30, 31, 32, and 37 can be of various types, but must be of small cross section and completely tight (preferably of the piston type). Two pipes lead from the mercury tank 36 to the gage, mounted to the front panel of the stand. The reservoir of the fuel pump is used as a collector 39. The mounting is done over pipes of 3-mm inside diameter.

The pressure gage 10 is a glass tube of 1650 mm length and 8 mm inside diameter. The panel carries a scale with a mercury column graduated in mm.

The fuel-tank filters are made of flat brass strips on a hard base with a screen. The gages 4, 8 and 35 are mounted to the tanks to control the fuel intake and outflow while testing the units. Each capacity is rated and marked on the scale opposite the gage. A glass tube of the required length, 10 x 12 in cross section, is installed in the corners, which are sealed with asbestos gaskets, treated with adhesive (shellac is also acceptable), and then fastened with a nut.

The electric wiring diagram of the pump test stand is shown in Fig.2. The system is wired with single wires, using LPRGS conductors. Ammeters 8 and 9 of

POOR ORIGINAL

the 50-amp MK-55 type, a volt meter 15 of the 130-v B-140 type, the switches 2, 5, 14, 16 of the PP-45 type, and the switches 19, 20 of the 3 PPN-45 type are mounted to the front panel. Electric motors are mounted in the following way: the motor 1 of the D-150 type with a pump, installed on the horizontal platform, with the fishplate toward the left; the motor 7 of the MBP-3 type with a pump, installed at the bottom of the frame (the RBP-45 type rheostat 12 is mounted on the vertical panel); and motor 4 of the D-200 type with a pump, mounted on the panel below the horizontal platform. The electric motor 10 of the MBP-3 type with a pump is mounted on the panel, to the right of the pump with a D-150 motor.

In the system, two ammeters 8 and 9 are used which, by means of the switches 19 and 20, can control each pump separately or two pumps of different groups at once. This arrangement permits direct use of ammeters. The switches 19 and 20 are connected with the ammeter terminals over their center contacts. The 40-amp inertia fuse is meltable, and the 25-v receptacle can be of any type.

POOR ORIGINAL

REVIEW AND BIBLIOGRAPHY
TEXTBOOK ON AIR NAVIGATION

by

Lecturer, Candidate of Technical Sciences, V. Polyak

Broad circles of flying personnel, instructors, and cadets of aviation schools had impatiently awaited the publication of a new textbook on air navigation, which is understandable if we recall that the last publication of a textbook of this type occurred in 1947.

During this period, the Military Air Forces changed to jet technique. The Socialist industry has produced new VVS (Military Air Forces) airplanes with modern navigation equipment. All this, naturally, results in higher demands on modern textbooks on aviation.

The book "Air Navigation" was written by experienced authors, well known to our flying personnel, M.F. Gorshkov, N.F. Kudryavtsev, R.V. Kunitskiy, and A.I. Torgman. The introduction and general editing of the textbook was done by Major General of aviation V.I. Sokolov*.

The book is intended as a textbook for aviation cadets of pilot schools and for flying personnel of the combat units of the VVS. Therefore, the authors selected a sequence of material presentation that closely follows the program of the air navigation course in pilot schools.

The author of the introduction, after describing the basic principles of the subject of air navigation as a science, including theoretical and practical aspects,

* See Bibl.2

POOR ORIGINAL

gives brief data on the history of air navigation. In the beginning, he describes the achievements of the founders of the Russian science of aviation and of the first Russian pilots in the progress of air navigation and later characterizes the main stages of development of the theory and practice of air navigation during the time of creation of the Military Air Forces in our country, in the period of reconstruction, during the years of the pre-war Five-Year Plans, during the Great Patriotic War, and finally during the post-war period.

The rest of the material of the book is divided into two large sections. The first part - "Principles of the Theory and Air navigation Aids" - consists of six chapters (Chapters 1-6); the second part - "Practice of Air Navigation" - includes five chapters (Chapters 7-11).

The theoretical principles of air navigation are explained in the first three chapters of the book, and flight maps as well as general means of air navigation are given. All these chapters are written by N.F. Kudryavtsev.

The fourth chapter of the first part is dedicated to radio-technical aids for air navigation, (author: M.F. Gorshkov). Unfortunately, they are described in less detail than the general and astronomic aids, to which chapter 5 is dedicated.

The first part is concluded with Chapter 6, which analyzes the question of visual orientation. This chapter occupies a special place in the Section on "Principles of the Theory and Air Navigation Aids", because it contains neither the problems of the theory or any description of navigation aids. This chapter (the author is A.I. Torgman) gives the characteristics of the main landmarks, a Table of their visibility, the conditions for visual orientation during day or night, and finally, the rules for conducting visual orientation. Perhaps this chapter, by virtue of its contents, would fit better to the second part of the book.

The second part (the author of the entire part is A.I. Torgman), is dedicated to the preparations for flight, the navigation of multiseaters, peculiarities of navigation of a single-place airplane, air navigation in a group flight, and maneuvering.

The book is concluded with Chapter 11, devoted to the peculiarities of airplane

POOR ORIGINAL

navigation under different navigational conditions: over a locality without any landmarks, above the sea, in mountains, during the night, at high and low altitudes, in clouds and above clouds.

By contents and composition, the new textbook, "Airplane Navigation", satisfies the demands made on a modern textbook on airplane navigation for aviation schools.

The author collective and the editor have a proper solution for the complicated problem, of characterizing the navigation aids without separating them from their practical application in flights. Solutions for navigation problems are given in the second part of the book, while consideration of new navigation aids is contained in the first chapter. Here, it is again of advantage that, rather than describing individual types of instruments, the authors give the structural diagrams and operating principles of the best typical designs. Such a solution can be considered progressive methodics in compiling of a textbook on air navigation.

The bulk of the material offered by the authors successfully shows the qualitative changes in the technique of combat use of these aids during recent years in the Air Forces. The illustrations are descriptive and helpful in the text.

The book, undoubtedly, will find an extensive use not only among the flying personnel of the Air Force and cadets of aviation schools, but also among the cadets of DOSAAF aeroclubs and schools of the commercial airlines.

It is unfortunate that the book, which is much needed by our aviation personnel, was edited only four years after the work on it had been started by the collective of the authors. Maybe the question of a sharp reduction in the time required for the publishing of school literature has become acute? It frequently happens that a book becomes obsolete even before it is published, due to the fact that aviation technique and the methods of its use progress so rapidly. This premature obsolescence, as illustrated below, can be found in several chapters of "Airplane Navigation".

Undoubtedly, the book "Airplane Navigation" will be very helpful in the train-

POOR ORIGINAL

ing of our flying cadets, especially for youth education. However, we would like to point out several drawbacks of the book. An elimination of these errors in later editions will help the authors to improve its contents.

The main criticism by the reader could be directed toward the authors of Chapters 8 and 10 - A.I.Torgman, and also of Chapter 4 - M.F.Gorshkov.

On a cursory examination, the fourth chapter (Radiotechnical Aids for Air Navigation), leaves a good impression. The author states the physical operating principles of air navigation aids. Later he describes the operating principle and basic uses of signal towers, airborne and ground direction finders, and finally of radar stations for observation and guidance.

However, this first impression is partly canceled when considering the contents of the entire chapter. There are none of the data of interest to the reader such as descriptions of designs, methods, and means employed in new radionavigation systems. Only eleven lines are devoted to panorama systems, 18 lines to hyperbolic systems, and 25 lines to airborne radar stations. Six pages are given over to radio-signal towers working by zone and bearing, of a type not used in the Air Forces, but no descriptions are given of signal towers with a vertical radiation pattern, so-called radiometers, often used for coordinating and landing operations and, generally, for taking bearings on radio stations.

Unfortunately, the new textbook contains none of the material previously published in popular books on air navigation, e.g., in the booklet by G.A.Babay, "Radio and Airplane Navigation". The mentioned omissions are especially obvious since the problems of construction and use of radiotechnical aids belong to the most complicated items in aviation schools.

The chapter "Piloting of Multi-Place Airplanes" analyzes the methods of solving navigational problems at different stages of a flight. It would seem that, since the student had become acquainted with the navigation aids in the first part, it would be appropriate to show in this particular chapter the complex use of these aids for the solution of navigation problems. Unfortunately, the author directs

POOR ORIGINAL

his principal attention to the solution of navigation problems under condition of ground observation by visual orientation, i.e., direction-finding by conventional means of airplane navigation. The use of radiotechnical means of air navigation is described insufficiently.

Leaving the line of the prescribed course by radiotechnical navigation is described in detail, while basic elements for the flight, such as flight control, determining navigation elements, and the position fixing by radiotechnical and astro-nomic means, are hardly mentioned. Almost no data are given on new radionavigation systems, and airborne ground-orientation stations are not mentioned at all. The author completely ignores the existence in modern airplanes of such important auto-matic navigation instruments as the course indicator. The use of this instrument, particularly for the control of the course, for position fixing, and for a series of navigational fixes is compulsory, especially in single-place aircraft. However, neither in the Chapters 8 or 9 is there any mention of the use of course indicators.

Also, Chapter 10 contains no instructions on the use of radiotechnical aids under conditions of atmospheric and artificial handicaps.

The interest in the method of visual position fixing sometimes leads A.I. Torgman away from the real evaluation of the situation. Thus, on pages 280-283 he gives com-pletely unreal cases of position fixing of the airplane by taking visual bearings on one or two landmarks, transferring the lines of visual bearing or its generalization; similarly, the methods of determining the airplane position from vertical and longi-tudinal angles of the landmark are vague.

First, he should have known that the modern combat airplane has no optical vision (sights permitting a determination of the vertical angles and distances) of lateral landmarks. Secondly, fixing the airplane position by visible landmarks with graphical plotting of line visual bearings on the map demands considerable time, and that the high speed of modern airplanes makes the entire method useless.

In our opinion, the chapter on visual bearings should be excluded from the course of airplane navigation and only the problems of direction finding left in the

POOR ORIGINAL

chapter on use of radiotechnical means, where direction finding has an important meaning.

In Chapter 8, no attention is given to checking the accuracy of the methods for the solution of navigation problems by different means of airplane guiding.

Problems of correctly determining the separate navigational elements, the lines of position, and the position of an airplane, were considered by only one author - R.V.Kunitskiy, in the chapter "Astronomical Aids for Airplane Navigation". However, by choosing one or the other of the methods of navigation or the method of its use, the problem of the correctness of the solution of a given problem has an important meaning and, therefore, has to be given certain consideration.

In Chapter 10, devoted to airplane guiding and to group maneuvering, the author considers group action only under conditions of ground visibility. Group concentrations under complex weather condition is disregarded. However, exactly such concentrations, while using certain ground and airborne radiotechnical aids, is of prime interest.

The author paid more attention to the assembly of large groups (commands) on a loop and on a course flight, than to all other methods of group concentration together, despite the fact that the organization and calculation of a command gathering is of interest, generally, to the command personnel rather than to cadets, pilots, and navigators.

Organization and calculation of group concentrations are closely correlated with breaking up of formation, landing approach, and landing of group airplanes. During assembly and landing, these same radiotechnical means and other special ground and airplane equipment are used. Breaking through the clouds upward (on gathering) and downward on landing, is computed by approximately this same formula. We regret that A.I.Torgman did not discuss landing in Chapter 10 and thus left the reader without information on the most vital problems in the practice of airplane guiding.

The second part of the book (Practice of Airplane Guidance) contains inadequate

POOR ORIGINAL

coverage of the elements of navigational possibilities of radiotechnical and astronomical means, and also of the peculiarities of airplane guidance under complex weather conditions and interferences.

The book has other, less significant defects. For example, there are no descriptions and keys to the problem of a navigator slide rule. However, the new slide rule has certain advantages over the older type. The new rule gives a very convenient way of computing the radius of the turn and banking in the turn, gives corrections for the readings of the compound speed indicator (KUS), permits estimating the speed and altitude required for stratospheric flights, etc. In the book, only a photo of one of the sides of the new rule is given, and an incomplete list of the scales is shown.

The book also contains partially obsolete matter. For example, the sequence of deviation maneuvers described here does not correspond exactly to the accepted standards in the units of the Military Air Forces. The description of the flight indicator (page 117) is unacceptably short, with reference to its great practical possibilities, which were revealed during practice flights. An obsolete potentiometer distant-reading compass is described on pages 62-63, instead of the modern one. Pages 94-95 describe a method of determining the true air speed, which is no longer in use and had been suggested in 1913 by V.Naydenov. This latter fact is not mentioned by the author. Except for R.V.Kunitskiy, the authors of the other chapters do not consider the history of air navigation and obviously thought the material given in the introduction sufficient. From the methodical point of view, we think that it would be more correct for the authors who introduced the important problems to have given some material on the leading role of scientists and pilots of our country in the development of new methods and means for air navigational pilotage. Such an approach, without doubt, would increase the educational significance of the textbook.

The book contains disappointing inaccuracies. For example, on page 33, the bearing line is mistakenly called the line of airplane position, just as the line of

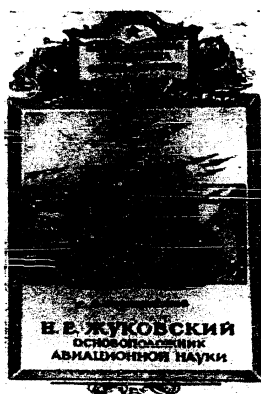
POOR ORIGINAL

equal bearings and the line of equal altitudes. On page 35 is printed: "The third speed (side: -V.P.) of this triangle is the wind vector". Inaccurate formulations are very frequent in the chapter "Guiding Maps". On page 44 (Fig.32) it is shown that the image of the pole, in simple polyconic projection, is a dot which is incorrect (in this projection, the pole will look like an arc with a circumference of limited length). In the description of the projection by the principle of distortion (page 410) no mention is made of equal intermediate projections, which are used in practical aviation in the form of the equal-intermediate azimuth projection, graphic maps for approaching darkness or dawn, time zones, etc. In short, in the description of maps accepted for airplane guidance, the author fails to mention the use, purpose, and type of aviation employing these maps. Maps of polyconic projection and equal-interval azimuth projections are missing. Only two methods of plotting, loxodromic and orthodromic, are described by the author. There is no mention in the chapter of the line of different azimuths, spherical circumference (orbits) and hyperbolas; nothing on this subject can be found in the chapter "Radiotechnical Aids for Airplane Navigation". Thus, the reader who desires to study the methods of preparing a map for position fixing by radiocompass or of using circle systems, or who wants to learn the purpose of hyperbolas and how they look on the earth's surface and on a map, will have to look for other material for reference. These are the few drawbacks of this otherwise vital and helpful textbook. If these errors are eliminated, the book will be even more effective and helpful.

POOR ORIGINAL

NEW BOOKS ON AVIATION

N.Ye.Zhukovskiy - the Founder of Aviation Science



The Military Publishing House of the Ministry of Defense of the USSR, has recently published in the series "Popular Science Library for Soldiers and Sailors", a book* on a brilliant scientist and an ardent patriot of our Fatherland, outstanding engineer and talented pedagogue, the father of Russian aviation, Nikolay Yegorovich Zhukovskiy.

The book has five chapters, the first of which is the introduction. In this chapter the author briefly reviews the meaning of the work of the Russian scientist, Nikolay Yegorovich Zhukovskiy.

The second chapter contains information on Nikolay Yegorovich's childhood, his years in high school, and at the University of Moscow.

The third chapter of the book is devoted to the beginning of the scientific activity of N.Ye.Zhukovskiy. This short chapter tells how Nikolay Yegorovich finally decided to become a scientist-researcher and discusses his Master of Science and Ph.D. degrees.

* See Bibl.3.

POOR ORIGINAL

The entire fourth chapter describes the scientific activity of N.Ye.Zhukovskiy before the Great October Revolution. The fifth chapter contains material on Nikolay Yegorovich's work under the Soviet government and data on the further development in the practical realization of his scientific inheritance.

The Soviet government and the Communist Party highly esteem the fifty years, of scientific and social activity of N.Ye.Zhukovskiy. His tremendous merits as the father of Russian aviation were mentioned in a special resolution adopted by the Council of the People's Commissars on 3 December 1920, signed by V.I.Lenin.

Zhukovskiy's ideas in the field of propellers and helicopters were developed by Russian scientists. The author of the book convincingly shows that the modern Soviet designs of the helicopter are based on the theoretical principles developed by Zhukovskiy. Considerable attention is paid in the book to the development of Zhukovskiy's ideas in the field of the wing theory and gas dynamics.

Following N.Ye Zhukovskiy's testament, Soviet scientists, designers, and engineers greatly contributed to the future development of the basic problems of modern science and technique. The book describes the persistent efforts contributed by the pupils and followers of Zhukovskiy to the progress in the development of high-speed and high-altitude jet airplanes.

This book by S.Ya.Strizhevskiy will be read with interest by a wide circle of readers.

JET AVIATION

Under this heading, the Publishing Company "Znanie" published a lecture by I.A.Merkulov at the end of last year. This lecture briefly describes the great accomplishments of our native scientists and engineers in the field of jet propulsion and proves on practical examples that our country occupies a leading position in the development of jet airplanes and indicates the future ways of Soviet aviation.

The author shows how scientists and engineers of our Fatherland have created a jet engine which, at low weight and small size, develops great power. The advan-

POOR ORIGINAL

tages of jet engines over piston-type engines show also in the fact that the jet engine can work at high altitudes and in the rarefied layers of the atmosphere.

The lecture also describes the design and operating principle of the liquid-fuel, ram-jet, and (the most extensively used type) turbo-jet engine, with compressors of the axial and centrifugal type.

In speaking of the first jet airplanes and of flights with them, I.A. Merkulov emphasizes that jet airplanes have been developed on the basis of persistent and creative work in developing special aircraft intended for flights at high speeds. With this purpose as a goal, as generally known, old designs of fuselages, wings, and tail units were modified and new ones developed.

The progress in Soviet jet aviation, as emphasized in the lecture, has been made possible by the effective industrial-technical basis of our country. Considering the material and technical possibilities of our aviation industry, the author predicts, not without reason, that in the very near future, airplanes will be traveling at speeds up to 2000-5000 km/hr.

HELICOPTER IN FLIGHT

A helicopter is one of the remarkable mechanisms of Soviet aviation. It does not require special airfields and can climb vertically into the air or land on a landing field of limited area.

A book, written by V. Barshevskiy, "Helicopter in Flight" and published by the Publishing House DOSAAF, gives information on the construction and operating principle of this remarkable mechanism.

The book contains six chapters describing the operating principles and flight of a helicopter, operation of the rotors, engine, and control elements, and the mechanical properties.

The introduction shows the indisputable priority of our country in the development of this remarkable mechanism and indicated the possibility of its use in the field of national economy.

POOR ORIGINAL

In this book, it is emphasised that the helicopter was used successfully by the floating stations ("North Pole-3" and "North Pole-4") in the icefields of the Arctic Ocean. "And I would like to predict once more", - writes the author- "that in a few years from now helicopters will be used to such an extent that we will wonder how we could have done without them previously."

The State Publishing House for Technical-Theoretical literature has also published a booklet written by L.K.Bayer "Helicopter", from the series of the "Popular-Science Library". Here, as in the book by V.Barshevskiy, data are given on the history of the helicopter and on flights with this machine.

Separate chapters are dedicated to Soviet helicopters and their operation.

The author concludes, underlining that "A helicopter and an airplane can co-exist...Both are important, and each has his own purpose. In aviation they supplement each other and are successfully employed each in his own field".

POOR ORIGINAL

YOUR DECISION?

WHAT DECISION WAS TAKEN BY THE PILOT?

A pilot was assigned the mission of firing at an aerial towed target from a combat gun carried by a MIG-15, using a fixed sight of the ASP-3i type. The attack proceeded from the rear hemisphere at a course of $2/4$. The speed of the towed airplane was $V_{ts} = 540$ km/hr.

At the moment at which the target was expected to appear in the sight, in accordance with the predicted lead angle for the given firing order, the bulb of the lamp burned out. Replacement was impossible.

What decision was taken by the pilot? How did he accomplish further aiming?

WILL THE NAVIGATOR SEE THE LIGHT?

On 8 June 1954, a navigator was determining the correction c for the sextant by comparing the actual height (calculated) of the source of light $h_{calc.}$ with the height $h_{meas.}$ of the same source of light, measured by means of the sextant at the moment of its highest culmination.

$$c = h_{calc.} - h_{meas.}$$

The moment of highest culmination occurred approximately at midnight.

Six months later, the navigator decided to determine the correction for the sextant again by employing the previous method and the same source of light.

At what culmination will be the source of light at the moment when its height will be measured? Will the navigator see this certain source of light in the sky at the time, if the latitude of his observation point is $\varphi = 49^{\circ}17'$, and the de-

HOW HAS THE NAVIGATOR DETERMINED THE COURSE?

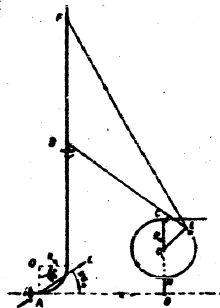
Determine the distance from the edge of the cloud to the initial point of the maneuver A, provided that the aircraft, in executing the maneuver, has touched the circumference at the point B, whose radius is $r = 5$ km, and determine the course MK₂ given by the navigator to the pilot at the point D, if the distance from point A to NBP was 85 km; the radius of deployment during the maneuver was $R = 12$ km.

WHAT ARE THE COURSE AND THE TIME OF OVERTAKING?

124

POOR ORIGINAL

At the beginning of the deployment of the fighter at the point C, the target began to turn left at the point A and then started to follow a course 90° less than



the prescribed course. The fighter airplane, continuing his left turn, arrived at the point E, while the target during this time reached the point D, along the course of the fighter.

What IK_1 , securing the interception of the target at point F, was given by the navigator to the pilot when he was at point E, and what was the time of overtaking the interceptor from point E to point F, provided that the course of the target at point A was $IK_1 = 20^\circ$; the velocity

of the target, $V_1 = 700$ km/hr; the radius of the turn of the target, $R_1 = 6.6$ km; the speed of the interceptor, $V_2 = 800$ km/hr; the radius of deployment of the interceptor, $R_2 = 8.7$ km; the time of flight of the target from point A to point D, 3 min, 49 secs?

HOW DID THE NAVIGATOR DETERMINE COURSE AND SPEED OF THE AIRCRAFT?

While flying above the clouds, the navigator guided the aircraft toward a point at which at $10^h 12^m 30^s$, he had determined (by means of radar) the angle of approach of the aircraft, $KU_k = 90^\circ$ and the distance $D_1 = 24$ km. From the given point, the navigator guided the plane at a course of $IK = 60^\circ$. At $10^h 27^m 48^s$, the pilot deployed the aircraft at 180° (left maneuver) and flew it on a course of $IK = 240^\circ$. At $10^h 42^m 30^s$, the navigator again determined by radar the angles of approach of the aircraft $KU_k = 270^\circ$ and the distance $D_2 = 46$ km.

How did the navigator determine the course and the speed of the aircraft, provided that the flying speed was 500 km/hr and the radius of deployment was $R = 5$ km

POOR ORIGINAL

(not considering the wind)?

TO WHAT ARE ω_i AND ψ_r EQUAL?

A fighter pilot was accomplishing a flight intended for executing a maneuver and firing at a single bomber. Under the terms of the mission, he was to accomplish the attack from the rear hemisphere of the bomber flying at a speed of 612 km/hr, and by a $2/4$ course. Since the sliding grid of the sight was not available, the pilot had to aim by using the fixed grid.

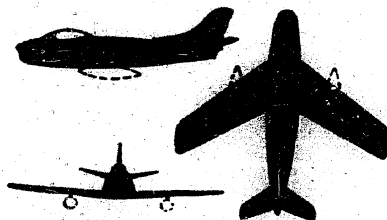
Determine the angular speed of the target ω_i and the relative lead angle ψ_r , when firing guns from 600 m. Known are the relative initial speed of the projectile 700 m/sec, its ballistic coefficient $C = 0.9$, the altitude of flight 500 m/sec, and the speed of an interceptor 720 km/hr.

How will ω_i and ψ_r vary with the decrease in directional angle of the target and the range of firing?

DETERMINE THE LINEAR AND ANGULAR LEAD

Determine the linear and angular lead when firing from a waist gun at an angle of $\beta = 150^\circ$, at an altitude of 2000 m, and at a speed of 520 km/hr. The aerial target is flying at a speed of 720 km/hr at the course angle of 50° . The firing range is 300 m, the initial speed of the projectile 800 m/sec and its ballistic coefficient 3.4.

DETERMINE THE TYPE OF AIRPLANE



Determine the type of airplane, its designation, and name its basic, tactical, and technical characteristics.

POOR ORIGINAL

I SOLVED.....

ANSWERS TO THE PROBLEMS PUBLISHED IN NOS. 1 AND 2 OF 1955

A.R. Lebedinskiy and A.I. Ryadovskiy

WHAT SHOULD THE PILOT DO?

An airplane flying horizontally is subject to the action of four forces: gravity G , thrust P , lift Y , and drag Q .

In gaining altitude, the force of gravity is resolved into two components from which one, G_1 , is counterbalanced by the lift Y_1 , and the second, G_2 , together with the drag Q , is counterbalanced by the thrust P_1 .



The lift Y_1 , while the airplane gains altitude, is smaller than the lift Y in a horizontal flight, since it counterbalances only a part of the airplane gravitational force, while the thrust P_1 must be greater than the thrust P in a horizontal flight, since it counterbalances not only the drag but also the second component of the gravitational force G_2 .

The angle of attack of the wings, on a change in airplane altitude from horizontal flight to climb, without change in flying speed, must decrease (in practical use, this decrease is negligible).

For the lift during a horizontal flight

$$Y = C_L S \frac{\rho V^2}{2}$$

and for the climb

POOR ORIGINAL

$$Y_1 = C_L S \frac{\rho v^2}{2}$$

we have established that $Y > Y_1$.

Neither the wing area S , nor the density of the air ρ , at the instant of change from level flight to climb can be altered, and the speed also has to be left constant in view of the conditions of the problem. Therefore, for a decrease in lift, it is necessary to reduce the coefficient of lift C_L by reducing the angle of wing setting.

A pilot, while changing from a horizontal flight to a climb, without change in flying speed must increase the thrust of the engine and the angle of airplane inclination and reduce the angle of attack of the wings.

TO DETERMINE THE ENERGY OF THE ATOMIC NUCLEUS

V.G.Kavkayev, A.Ye.Rogalenko, A.I.Ryadovskiy, I.I.Zinkoyev

1. The mass of the nucleus of the atom of uranium-235 is less than the sum of the mass particles which compose this nucleus and the magnitude of mass defect Δm , i.e., the mass due to the composition of the nucleus.

The mass defect is equal to the difference between the sum of mass particles which compose the nucleus (while they are in a free state) and the mass of the nucleus.

The sum of the particles which compose the nucleus when they are in the free state is equal to

$$92 \times 1.0076 + 143 \times 1.0089 = 236.9719 \text{ at. mass units}$$

The mass defect will be equal to

$$\Delta m = 236.9719 - 234.944 = 2.0279 \text{ at. mass units}$$

The bond energy in the nucleus of the atom of U^{235} will be

$$E = 2.0279 \text{ at. mass units} \times 931 \text{ mev} \approx 1888 \text{ mev}$$

2. Determine the amount of gasoline required to produce the energy equal to the nuclear energy of 1 kg of U^{235} .

POOR ORIGINAL

The nuclear energy one kilogram of uranium in kcal will be equal to

$$1888 \text{ mev} \cdot 2.56 \times 10^{24} \times 3.83 \times 10^{-17} \text{ kcal/mev} = 18,520 \times 10^7 \text{ kcal}$$

To obtain an energy of such a magnitude, it is necessary to burn the following quantity of gasoline G with a heat capacity of 10,500 kcal/kg:

$$G = \frac{18,520 \times 10^7}{10,500} \approx 1.76 \times 10^7 \text{ kg} \approx 17,600 \text{ tons of gasoline}$$

EXPERIENCE WITH WINTER OPERATION

K.K. Kopylov

Spontaneous overflow of the fluid compensation tank occurred in one case because of the unequal compression existing between the hydraulic and air spaces in the retraction and extension cylinder of the main strut of landing gears. Air had leaked from the air space into the hydraulic space and was expelling the fluid which then leaked from the compensation tank.

HOW DOES A NAVIGATOR DETERMINE THE FLYING SPEED?

A.S. Titov

The flying time of the first group is

$$t_1 = \frac{S}{V_1} = \frac{77 \text{ km}}{740 \text{ km/hr}} \approx 6 \text{ min } 20 \text{ sec}$$

The group will gain the position NBP₁ at (12 hrs 20 min + 6 min 20 sec) 12 hrs 26 min 20 sec.

The flying time of the second group is

$$t_2 = t_1 + 2 \text{ min} = 6 \text{ min } 20 \text{ sec} + 2 \text{ min} = 8 \text{ min } 20 \text{ sec}$$

This group will gain the position NBP₂ at 12 hrs 28 min 20 sec.

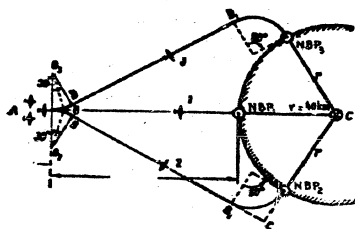
The flying time of the third group is

$$t_3 = t_2 + 2 \text{ min} = 10 \text{ min } 20 \text{ sec}$$

POOR ORIGINAL

This group will reach the position NBP_3 at 12 hrs 30 min 20 sec.

The flying speed V_2 and the lateral inclination at the point of deployment β_2



of the leader of the second group can be determined as follows:

$$V = \frac{S_2}{t_2}$$

where

$$S_2 = \text{arc } AB + BB_1 + \text{arc } B_1 NBP_2$$

$$\tan \beta_2 = \frac{V_2^2}{Rg}$$

The speed and the lateral inclination at the deployment of the leader of the third group can be determined analogously.

Let us determine the path of the leader of the second group S_2

$$S_2 = \text{arc } AB + BB_1 + \text{arc } B_1 NBP_2$$

where

$$\text{arc } AB = \frac{2\pi R}{12} = \frac{2 \times 3.14 \times 16}{12} = 8.37 \text{ km}$$

$$\text{arc } B_1 NBP_2 = \frac{2\pi R}{4} = \frac{2 \times 3.14 \times 16}{4} = 25.12 \text{ km}$$

POOR ORIGINAL

$$BB_1 = OE - OB - B_1E = OE - R \tan \frac{30^\circ}{2} - R$$

where OE can be determined from the triangle OCE

$$OE = \frac{CE}{\tan 30^\circ} = \frac{r + R}{\tan 30^\circ}$$

$$BB_1 = \frac{r + R}{\tan 30^\circ} - R \tan \frac{30^\circ}{2} - R = \left(\frac{40 + 16}{0.58} - 16 \times 0.27 - 16 \right) = 76.2 \text{ km}$$

$$S_2 = (8.37 + 76.2 + 25.12) = 109.69 \text{ km}$$

$$V_2 = \frac{109.69 \text{ km}}{8 \text{ min } 20 \text{ sec}} = 790 \text{ km/hr}$$

$$\beta_2 = 17^\circ$$

$$S_2 = S_3$$

$$V_3 = \frac{109.69 \text{ km}}{10 \text{ min } 20 \text{ sec}} = 630 \text{ km/hr}$$

$$\beta_2 = 11^\circ$$

POOR ORIGINAL

AVIATION ABROAD
BACTERIOLOGICAL WARFARE

by
G. Starko

Recently, the military press of the United States of America, as well as their entire propaganda machine, are trying insistently to prove that bacteriological weapons are a "standard" means of warfare. "At present, the bacteriological weapon has assumed a position similar to that occupied by machine guns, submarines and tanks, before they became extensively used in warfare" states the Chief of Chemical Warfare of the American Army, Major General William M. Creasy, trying to convince the reader in an article printed in the magazine "Army Information Digest" (No. 1, January 1955).

This analogy, which does not stand up under any criticism, is needed by the candidate for military criminals for the purpose of justifying the summons in his article, for preparedness to undertake "both offensive and defensive actions" not only by means of "nuclear and thermonuclear weapons, but also by means of guided missiles, chemical, biological, radiological, and psychological means of warfare".

American generals are not disturbed by the fact that the use of bacteriological and chemical warfare agents has been condemned by all of mankind at all times.

For long now, the American Armed Forces have been using barbaric methods of warfare. Thus in 1763, the Governor of Nova Scotia, General Amherst, issued an order to Colonel Buckett to spread smallpox among the Indian tribes, suggesting "to use any means for destroying this damned race".

POOR ORIGINAL

0 In 1898, American troops drowned in blood the Republic of the Philippines. Amer-
 2 ican General Smith, acting on behalf of McKinley, said in an address to the troops:
 4 "I do not want any prisoners. I want you to kill and burn and the more you kill,
 6 the more you will please me".

8 American leading circles were the first to employ the atomic weapon against the
 10 peaceful inhabitants of two Japanese cities, Hiroshima and Nagasaki, without any need
 12 for it from the military point of view: Japan was ready to capitulate anyhow. Final-
 14 ly, the United States extensively used bacteriological weapons in North Korea and
 16 Northwest China.

18 The American government persistently opposes propositions for an international
 20 agreement to prohibit the means for mass destruction of man.

22 The governing circles of the United States of America entered the road of prep-
 24 aration for bacteriological warfare as early as 1942. In Camp Detrick (State of
 26 Maryland) laboratories and plants manufacturing death-dealing bacteria were built.
 28 Later, the research centers for experimenting with bacteriological agents were also
 30 established in the States of Mississippi, Utah, and Indiana. After the end of World
 32 War II, American military circles acquitted the Japanese organizers of bacteriologi-
 34 cal war and engaged them for work in their laboratories.

36 In 1952, the United States of America decided to start mass production of bac-
 38 teriological weapons. It was publicly acknowledged by the chief of the Chemical
 40 Corps of the American Army, Major General Besson, who stated in one of his public ap-
 42 pearances in the beginning of 1952, "We have been working on the research for ten
 44 years and we think that we are now ready for mass production of weapons".

46 After the production of bacteriological weapons was organized, the United
 48 States of America began mass use of the weapon. In January of 1952, the American
 50 Armed Forces started to drop death-carrying bacteria on the positions of the North
 52 Korean and Chinese volunteers. First information about the beginning of bacterio-
 54 logical warfare in Korea created a wave of indignation all around the world. All
 56 progressive mankind resented the new criminal action of the American imperialists.

POOR ORIGINAL

0 Frightened by the widespread movement, objecting to bacteriological warfare, Ameri-
2 can leading circles tried to suppress the evidence of the bacteriological war started
4 by them secretly. American propaganda tried to deny the existence of bacteriological
6 war in Korea itself. However, the criminals were not able to destroy the evidence.

8 A line of authoritative commissions, including the Commission of the International
10 Association of Democratic Lawyers and the International Scientific Commission inves-
12 tigated the reports on the use of bacteriological agents in Korea and China, where
14 voluminous data and scientific material were collected which accused the American ag-
16 gressor of the mass employment of bacteriological weapons against the Chinese and
18 Korean people.

20 In American terminology, a bacteriological warfare agent is defined as the live
42 organism or its toxic excretion, designated to produce epidemics or death among
16 people or animals and also to destroy and affect plant life. Since, for this purpose
26 not only bacteria but also other live organisms and their toxic products are used,
48 the bacterial weapon was given the more general term: Biological Weapon. However,
68 the term "bacteriological weapon" is more often used by the press.

70 The American military press often compares the bacteriological weapon with the
72 chemical weapon. Similar to the latter, it can be dispersed in the air, infecting
74 local objectives. Man, not protected by a gas mask or special clothes, will also be
76 affected. Bacteriological agents, like chemical agents, can penetrate various struc-
78 tures and shelters and remain in the contaminated area for a considerable length of
80 time.

82 Bacteriological agents, unlike a gas attack, cannot be detected by the usual
84 chemical and physical means. To detect them, a special bacteriological laboratory
86 analysis is required. The effect of the bacteriological weapon shows only after a
88 certain period of time (so-called incubation period) which, for different bacteria,
90 can fluctuate from several hours to several weeks. Finally, unlike gas, the bacter-
92 iological weapon is contagious not only for people directly affected by it, but al-
94 so for those who come into contact with the infected persons. The American military
96

POOR ORIGINAL

authorities divide the means of bacteriological aggression into two groups: microbes and other live organisms and poisonous substances, or toxins, which are secreted by the live organisms. Besides that, they are subdivided into means directed against humans, animals, and plants. American militarism considers the bacteriological agents used against humans as the most important.

The American press indicates that not all disease-producing microbes can be used as bacteriological warfare agents. For this they have to satisfy certain requirements. For example, there must be a possibility of producing the microbes in large quantities, and also of preserving and transporting them to the place of application. The microbes must be sufficiently resistant to survive under certain adverse conditions, the period of incubation of the sickness created by them must be as short as possible and their pathogenicity, i.e., the ability to produce infection, must be high, the diagnostics of the sickness must be made difficult and the exciting genus hard to detect. Finally, it is necessary to develop means of protecting one's own troops from the sickness spread in enemy sectors. These qualifications for bacteriological warfare agents have repeatedly been stated in the American military press. The trend of research for American military bacteriologists was also defined by these specifications.

At Camp Detrick and in other "death factories", methods of producing bacteria in large quantities and a way for their long-time preservation are being developed. The Mexican magazine "Revista Militar de Mexico" wrote that some types of bacteria can be preserved for several months. The Americans pay ever increasing attention to the manufacturing of toxins produced by the live organism, since the possibilities of stockpiling bacteria in large quantities are limited, because of the difficulty of preservation. Thus, the military press reported that American bacteriologists succeeded in separating the botulinus toxin in the pure state, which is known under the name of sausage poison, causing allantiasis. Published in 1947 in the USA, a report presented to the Pentagon by the Chemical Corps, on the potentialities of bacteriological warfare, contains a recommendation to disperse these poisons from the air to contaminate water reservoirs and other sources of drinking water. "Ex-

POOR ORIGINAL

0 actually this method, - states the report, - deserves consideration. The use of toxin
2 as a poison will cover the field of gas warfare as much as that of bacteriological
4 warfare".

6 In the USA, intensive works on the development of certain bacteria is carried
8 out, with the purpose of increasing their virulence and resistance and also of neu-
10 tralizing the effect of known defense measures. To handicap diagnosis of the sick-
12 ness produced, complex methods of mixed infection are developed in American labora-
14 tories.

16 Finally, various methods of spreading the death-carrying microbes are feverish-
18 ly being developed in American laboratories. There exist many such methods. The
20 press indicates that their selection depends on numerous conditions: on the peculiar-
22 ity of a certain microbe, the time and place of its application, the conditions of
24 anti-epedemic service of the enemy, and others. It is very difficult to name all
26 methods of microbe use. We shall limit ourselves to describing the methods which
28 were used by the American troops in Korea and in Northwest China.

30 In Korea they employed the method used by the Japanese during World War II, as
32 follows: flies infected with the plague and enclosed in special containers were
34 dropped from airplanes.

36 In Northwest China, the Americans used plague-infected field mice which were
38 dropped from airplanes into populated areas. The American bacteriologists calculated
40 that from the field mice, the sickness will be picked up by flies and eventually by
42 humans.

44 The microbes of malignant anthrax were spread by the American troops through
46 artificially infected flies, spiders, and also bird feathers, and the pulmonary form
48 of malignant anthrax - through infected bugs, which usually live in grain elevators,
50 and also through flies and bird feathers. People were infected as a result of com-
52 ing into contact with insects and feathers.

54 In Korea, cases were recorded of malignant anthrax spread through the respira-
56 tory organs which have confirmed the correctness of the information received by the

POOR ORIGINAL

foreign press as late as 1946-1947, indicating that the malignant anthrax bacillus, possessing not only increased virulence but also capable of spreading the infection through the respiratory organs, were created as a result of the research work in Camp Detrick.

The Americans tried to spread cholera by contaminating the drinking water supply with marine mollusks which were infected with the cholera vibrio. As stated in the report of the International Scientific Commission, these mollusks, when placed in the river water, could survive for a certain time because of their ability to close the flaps of their shells. During this time, the cholera vibrio multiplies and after the death of the mollusk its body can contaminate the water for about a month.

Besides the diseases mentioned above, the Americans were spreading typhus, typhoid fever, encephalitis, dysentery, chicken pox, etc. No doubt that in Camp Detrick and in other American laboratories many other barbaric agents and means of mass destruction are being prepared.

Bacteriological agents for the destruction of domestic plants were also used in Korea and Northwest China. These actions confirmed the statements of the American agricultural magazine, "Harvest Magazine", describing that "the destruction of the agriculture of foreign countries could become one of the most important subjects of study by the General Staff, which has developed practical measures for destroying seed plantings". This time, besides the Colorado bug which had been dropped by American saboteurs previously on the territories of Hitler Germany and Czechoslovakia to destroy the potato crop, the leaves of plants infected by a poisonous fungus capable of destroying soybeans - the most important agricultural product of Korea - were employed.

The leaves dropped by the Americans were artificially infected by a variety of fungus which, unlike the regular fungus that affects cotton plants, was able to contaminate also apple trees, pears, and other plants.

A report printed in the American magazine "Military Review", shows that in the

POOR ORIGINAL

USA, several hundred various hormone-like compounds have been developed. These compounds, when applied in great quantities, prevent any plant from growing in the infected area. "There exists the technical possibility" - wrote this magazine - "of devastating and changing such large territories as the whole of Western Europe or the whole of the Ukraine into barren deserts." Of course, the authors of similar statements represent their wishful thinking as actual fact, but statements of this type and the very fact of the use of bacteriological agents in Korea against plants, must put on guard the people of the democratic countries who spend great efforts in increasing their crop and in producing an abundance of agricultural products in their countries.

The use of bacteriological warfare agents by the Americans in Korea and China and also the statements made by the American bacteriologists in the American press, affirm that the means of bacteriological offensive can be spread by saboteurs, from airplanes and also by artillery and guided missiles. Scattering of the bacteriological agents by airplane is most widely used. This can be attributed to the fact that, from the aspect of American militarism, populated areas and concentrations of armies in the rear must be the first objectives of bacteriological aggression. The use of bacteriological warfare agents on the front is limited by the risk of infecting one's own armies.

As it follows from the report of the International Scientific Committee, the airplanes dropped the bacteriological agents enclosed in bombs or containers (less often without packing) or, occasionally, sprayed them from atomizers directly from the airplane. The US Air Force used several types of bomb containers for the scattering of bacteria and infected insects in Korea. In the report compiled by the International Scientific Committee, several types of these are described. Leaflet-type bombs exploded in the air by a time fuze, represents the most extensively used type of bacteriological bomb. This bomb has approximately the same size and form as the standard 250-kg bomb but weighs only 75 kg. The warhead is fitted with a time fuze. The cylindrical part of the bomb is divided into four compartments by

POOR ORIGINAL

three partitions. A stabilizer is attached to the end of the lower compartment. The end of the stabilizer carries an outlet through which a parachute could be ejected if a bomb is intended to drop at low speed. The length of the bomb described in the report, is approximately 1.4 m, with a diameter of 0.4 m, and a wall thickness of the metal shell of 3 mm. The over-all capacity of the four compartments is 72 liters. Sometimes the body of the bomb consists of two longitudinal halves, which separate at a certain altitude, spilling the contents. Based on statements of witnesses, bombs of this type can infect an area of 200×100 m with germ-carrying insects. The fuze in the warhead can be replaced by a small wind turbine which creates a certain number of rotations.

Paper and cardboard containers with walls of approximately 1 cm thickness were also used by the Americans. The length of such a container is 36 cm and the diameter, 13 cm. A silk parachute of 70 cm diameter is attached to the container.



Fig.1 - Bacteriological Bomb which Splits into Two Parts on Landing

The construction of the containers may differ. Thus, the Japanese magazine "San'de May-nichi" (Jan.1952) describes a container made of strong paper and fitted with a paper parachute and a fuze which is to set afire the container and release the para-

chute at the required moment. The container is intended for dropping rats infected with plague. After the rats have abandoned the container, it burns to ashes.

During World War II, the Japanese were manufacturing various porcelain containers in a special factory near Kharbin. The length of these containers was 50-80 cm. The contents were scattered over the area after the porcelain shell had broken on landing. The Americans changed the shape of these containers. For the shell they used a new brittle material consisting mainly of calcium carbonate, as

POOR ORIGINAL

was proved by an analysis of the fragments in the Institute of Applied Physics of the Academy of Sciences in China. Such containers with brittle walls were employed by the Japanese and Americans for dropping black flies, spiders, bird feathers infected with the bacillus of Siberian malignant anthrax. The Americans used also other types of containers, particularly cylindrical wire-net cages and wooden boxes for rodents. The mollusks infected with cholera were dropped from airplanes in straw wrappings. Foodstuffs and household articles infected with microbes were dropped from American airplanes on the Korean territory.

In Korea, the interventionists spread the bacteriological agents also directly from airplanes by spraying. Chinese volunteers watched American airplanes release



Fig. 2 - Unexploded American Bacteriological Bomb Filled with Infected Insects (Dropped by an American Airplane on the Territory of North Korea. Length - 106.5 cm, Diameter - 22 cm, weight - 18 kg)

insects from an altitude of 300 m. A similar method can be used for dropping flies, bugs, and various insects but not for mosquitos.

The American magazine "Life" as early as 1946, reported that the Chemical Corps had developed a method for dispersing pathogenic bacteria by means of the so-called aerosols. Aerosols are produced by atomizing oil solutions containing bacteria through fine nozzles under high pressure. Aerosols, as it was stated in the magazine, can be dispersed not only from airplanes, but also from guided missiles, dropped by bomb parachutes, or a cluster of small bombs, directed toward the target similar to incendiary bombs. A report on bacteriological warfare, published in 1947, contain the following statement on the use of aerosols: "Accurate methods have been developed for creating and measuring such 'mists', for saturating such 'mists' with microorganisms, and methods for studying factors that influence the movement of pathogenic microbes in the air."

POOR ORIGINAL

The bacteriological agents were spread by American airplanes from low altitudes (170-300 m) at a speed of not over 20 mph. To prevent identification of the "un-



Fig. 3 - Dispersion of Aerosols Saturated with Microbes by Airplane from Low Altitudes

exploded bombs" (this was the name given by the American command to the bacteriological bombs for camouflage) they were sometimes dropped together with regular bombs but at considerable distances from the latter.

The American military maintains that bacteriological weapons can be used both for offensive and defensive. For offensive, the bacteriological agents can be used in the deep rear and for defense - in areas of enemy landings and at points of enemy troop concentrations.

The report mentioned above, contains statements characteristic for the use of bacteriological weapons: "Against island Army, Navy, and Air Force bases and other points which must be rendered useless for the enemy but which are not intended for later occupation, bacteriological warfare agents are most effective and at the same time they do not reveal their tactical features. For this purpose, any carrier, suitable for the given climate and topographic conditions can be used...".

US propaganda uses all possible means for propagandizing the "exceptional efficiency" and "powerful effect" of bacteriological weapons and calls it the "weapon of the future".

They are trying to influence nervous and weak people, to break their will for resistance. However, the Americans succeeded in frightening only the ordinary American citizen. The example set by the heroic Korean people proves that there are sufficient and dependable means of protection from this dangerous kind of weapon. The use of such countermeasures made it possible for the Korean people to reduce the losses due to this weapon to a minimum.

POOR ORIGINAL

The American press ("Military Review" No.1,1950) classifies the countermeasures against bacteriological weapons into individual and group types. The individual countermeasures consist in observing general sanitary and hygienic rules. It is



Fig. 4 - Protective Clothing for the Decontamination and Evacuation Crews. The suit has an oxygen mask

recommended to use a gas mask which protects the respiratory organs from bacteria, and special clothes for protection from poison gases. However, even regular outfits can protect an organism from bacterial infection through the skin. For this purpose, all parts of the body must be covered; pants should be worn inside socks or tied with string at the bottom, and gloves must be worn. After evacuation from the contaminated area, careful washing is required, followed by disinfection.

The measures of group protection include shelters, prophylactic shots, protection of food-stuffs from contamination, disinfection of water by chlorinating or boiling, destruction of rodent and insects infected with the disease-producing microbes, etc. The necessary protective measures can be successfully applied when the type of the bacteria used by the enemy is detected in time.

"In the field of defensive biological war" - states the magazine Army Information Digest, - "the problem of immediate detection and identification of the disease is one of the most important or even the most important." Therefore, under conditions of bacteriological warfare, the role of reconnaissance acquires an even greater importance.

The organization of anti-bacteriological measures must be laid out, planned, and thoroughly prepared ahead of time. This will greatly reduce the effect of bacterio-

POOR ORIGINAL

logical weapons, used in a surprise enemy attack.

The American government, while preparing for criminal bacteriological warfare, is organizing in the country and in the Armed Forces a system of countermeasures against bacteriological weapons. American propaganda demands the creation of special commands at large military objectives or in industrial centers, giving them special authority to quarantine not only individual persons but entire areas. Obliging businessmen, already today, are trying to sell to the common American, of course for a certain amount of money, antibacterial protective clothing, ultraviolet lamps, filters, and other gadgets. Mass immunization of schoolage children is being undertaken. During the last year, as reported in the magazine "Science Newsletter", an experimental inoculation with Dr. Salk's vaccine against poliomyelitis of 1.5 million American school children was carried out. All this noise about protection from bacteriological contamination is necessary for the American leading circles to lessen the alertness of the American citizen and to have the opportunity for preparing a criminal bacteriological war. This end of the business was indicated some time ago by the American magazine, "Look" in articles and publications intended for the general public: "Military representatives discuss, above everything else, the protective measures against gas and bacteriological attacks. However, the fact remains that we, ourselves, are ready to employ such a weapon."

American leading circles will not succeed in deceiving the people. All mankind, excluding a handful of new candidates for military criminals, unanimously demands the unconditional outlawing of the criminal, barbaric weapons of American militarism.

POOR ORIGINAL

AVIATION CHRONICLE

RESTORATION OF THE WEST GERMAN MILITARY AIR FORCES

West German revengists are making feverish preparations for the creation of a new aggressive Wehrmacht. A large place in the plans for rearmament is assigned to the "Luftwaffe" - the West German Army Air Force.

As is generally known (see the journal "Vestnik Vozdushnogo Flota", No.9 for 1954) the plans for West German rearmament include creation of 10 fighter-bomber, 5 fighter, and 5 auxiliary tactical groups (a total of 20 airforce groups) with a total aircraft reserve of close to 1500 airplanes.

According to other data, published in the aviation bulletin, "Interavia" of 11 December 1954, this proportion (with respect to the above number of tactical groups and airplanes) will be changed toward an increase in fighters and a decrease in fighter-bomber groups. The journal "Interavia" writes: "This proposed change is due to the fact that aviation circles (of West Germany - Ed.) think that fighter-bombers will be capable of operating only if fighter-interceptors are able to provide air superiority".

West German Military Air Forces, as the newspaper "Die Welt" reports, will have the following combat strength: eight aviation groups of fighter-interceptors (75 airplanes in each - British "Hunter" or American "Saber")*; two aviation groups of all-weather fighter-interceptors (each having 36 airplanes of F-89 "Scorpion"), six fighter-bomber aviation groups (each having 75 airplanes of the F-86K

* The final decision as to the type of airplanes which will arm the West German MAF (Military Air Force) have not been published.

POOR ORIGINAL

"Saber" type); two aviation groups of fighter scouts (each having 54 airplanes RF-84F "Thunderstreak"); two transport aviation groups (each having 48 airplanes, whose type has not yet been established).

The West German Military Air Forces will be patterned on the US forces, as the English magazine "Aeroplane" of 10 December 1954 reports. The West German aviation task force will consist of three groups. A general equivalent in rank to a Brigadier General in the USA Military Air Forces will be in command. All aviation groups will be organized into two separate aviation commands, subject to the Commander of the West German Military Air Forces.

It is supposed that for the development of 20 groups as a minimum, 20 air bases will be required. At present, the airfields of the former "Luftwaffe" are being modernized and new ones are being built (mostly beyond the Rhine).

The West German MAF will contain only combat aviation groups. These are intended, as the magazine "Aeroplane" indicates, for accomplishing the following assignments: conquest of air priority, direct air support for the ground forces; isolating the combat area by day and attacking objectives and enemy troops in the combat area by night.

It is evident that the tactical principles of the use of West German Military Air Forces are mainly based on the American aspects of combat aviation.

The personnel of the West German Military Air Forces is limited by the Paris agreement, to 85,000 men (including more than 2000 pilots); the journal "Enteravia" of 11 December 1954, reports that the number will exceed 100,000.

The foreign press indicates that the training of the personnel for the future West German Military Air Forces, despite the existence of nearly 80 associations and societies of former servicemen of the Hitler Air Forces in the territory, is not without certain difficulties. One of them is the "age" problem. The fact is that Hitler's former pilots who, by the Bonn plan, should become the "nucleus" of the re-established "Luftwaffe" are becoming older with every year, while the youth, is not as trustworthy. The department Blank has determined that there are in West

POOR ORIGINAL

Germany about 30% of the former military servicemen of Hitler's Luftwaffe of the over-all planned number of West German Military Air Force personnel. Their names were recorded and they are ready for immediate retraining in jet aircraft; however the longer the delay in turning over the required airplanes to Germany - worries the "quartermaster" of the future "Luftwaffe", Max Heine, in the magazine "Aero-plane" - the less people will remain to attend the courses for retraining and re-orientation since these men become older every day.

The pilot training will be divided into three stages. During the first stage, the cadets will attend a basic training course in the simplest jet training airplanes. In the second stage, they will master the training in two-place British jet aircraft "Meteor" or in American T-33. During the third and final stage of the training, the cadets will master the modern jet fighter-interceptors "Hunter" (British) or the F-100 (American).

The following report in the foreign press indicates that the cadres for the West German MAF will be trained in West Germany, USA, Canada, Switzerland, and Spain.

At present, American and British military leaders are taking over the training of West German pilots. The British magazine "Flight" of 7 January 1955 reports that British pilots who will train the pilots for the West German MAF, had arrived at the American air base in West Germany Fuerstenfeldbruck (where some American T-6 and T-33 training airplanes are stationed).

Along with this, a feverish preparation for the restoration of all aircraft industry can be observed. The Reuter News Agency reported recently that "former aircraft industry executives and designers of West Germany are preparing to re-establish the aircraft industry in a short time. Similarly to the postwar period after World War I, the German militarists are organizing the production of combat aircraft in other countries, with the intention of starting their own aircraft production at the moment of re-armament of the new Wehrmacht. Thus, the American aviation textbook "Worldwide Aircraft" of 1954-1955, contains information on the manufacturing of a

POOR ORIGINAL

new combat liaison plane Do-25, by the Spanish branch of the German aircraft builder, Dornier.

Such are the new facts about the organization of the West German Military Air Forces. The feverish reorganization of the "Luftwaffe" is an indispensable part of the policy of revenge and aggression of the German militarists.

COMMENTS ON A LECTURE DELIVERED BY FIELD MARSHAL MONTGOMERY

The journal of the Royal Military Scientific Society, No. 596 of November 1954, contains a lecture delivered in London on 21 October 1954 by Field Marshal Montgomery, who is deputy commander of the Armed Forces of the NATO in Europe. The audience present at this lecture consisted of high-ranking officers of all types of troops of Great Britain, including the Chief of the Royal General Staff.

In this lecture, Montgomery stated that the Headquarters of the High Command of the Armed Forces of NATO in Europe is developing all operations plans on the premises of using atomic and H-bombs in the future war. Further, Montgomery indicated that a special group of experts who were with NATO Headquarters in 1954, studied the questions of the reorganization of the Air Forces relative to the use of atomic weapons and came to the conclusion that "the cooperation of the national governments is needed for applying these weapons in practice."

The World War III, as Montgomery asserts, will have three stages. During the first stage, decisive battles will be fought on a world scale for air and sea superiority. Here, the goal is to handicap the ground forces of the enemy, to occupy and neutralize bases and the territory of the countries belonging to the North-Atlantic Organization. The second period will bring the annihilation of the remaining ground forces of the enemy, and the third period will see the continuation of air attacks until the enemy accepts the conditions of surrender imposed by the aggressor.

Further, Montgomery discussed the war in the air, on the ground, and on the sea, individually. He asserted that air power will be the dominant factor and that, if NATO loses the war in the air, it will lose it in general and will lose it quickly.

POOR ORIGINAL

One of the important characteristics of "air power" is the versatility of its use which, in turn, depends on the methods of commanding and administrating the Military Air Forces.

Montgomery insisted that the Western countries have lost the ability of versatile use of military air forces, accepting as basis for the organization of aviation units and commands, the requirement of direct support of the ground forces, whereas the problem of maximum control in the air should form the basis of the organization. However, in speaking of the role of aviation in a future war, Montgomery stated that the Military Air Forces will solve the problem of supporting the ground forces and, in certain cases, will even use all existing air forces for protecting the ground forces from destruction.

Analyzing the problem of strategics in the organization of aerial warfare, Montgomery drew the conclusion that, in the initial period of war, it is necessary to launch an air offensive on as large a scale as possible, directed against the military air forces of the enemy and against essential strategic objectives in its territory.

In the air war, said Montgomery, we cannot depend on aviation resources that, in turn, depend on mobilization. Therefore, preparedness of the British Air Force, together with all means of support, is a prerequisite in time of peace.

After stating that Britain must be ready to start air aggression first, still in time of peace, Montgomery insists that, at present, the countries of the North-Atlantic Block have no adequate defense against atomic weapons, aerial bombs, and ballistic rockets. To overcome these deficiencies, it is necessary to attract the best scientific brains.

Montgomery advocated centralized operation of the entire armed forces that participate in a war. Particularly, he recommended "centralized operation by the Military Air Forces through the High Command Post which can use all existing Military Air Forces participating in the war activities, as one powerful weapon".

This thesis, offered by the British Field Marshal, reflects old intentions of

POOR ORIGINAL

the American military leaders to subordinate the strategic aviation of Britain to American leadership through the North-Atlantic Block.

BIBLIOGRAPHY

1. Abakumov, B. - Advantages of Zonal Observation. Vestnik Vozdush. Flota, No. 11 (1953)
2. - Air Navigation-Textbook. Military Publication of the Ministry of Defense USSR, (1955); 357pp
3. Strizhevskiy, S. Ya. - N. Ye. Zhukovskiy, the Founder of the Science of Aviation. Popular Science Library for Soldiers and Sailors. Military Publication of the Ministry of Defense USSR, Moscow (1954)

POOR ORIGINAL

TABLE OF CONTENTS

	Page
Editorial - The Great Power of Lenin's Concepts on the Defense of a Socialist State	1
N. Stepanov - The Glory of Achievement, The Grandeur of Victory	11
P. Brayko - Soviet Aviation in the Great Patriotic War	20
TACTICS	
A. Pokryshkin - Search for an Aerial Target	29
TRAINING AND EDUCATION	
S. Ushakov - High Altitude Bombing	45
L. Savichev - Pilot Activity during Interception	56
V. Akkuratov - Determining the Flight Course of an Airplane in the Circumpolar Region	63
V. Matyushko - Catapult Training	68
A. Nazarov - Pilot-Instructor	71
TECHNIQUE AND PERFORMANCE	
V. Pyshnov - Aerodynamics of Supersonic Speeds	79
V. Aleksandrov - Creative Advancement of Inventors and Innovators	89
V. Gorokhov and S. Khar'kovskiy - A New Method of Removing Dents in the Airplanes Coverings	95
READERS SUGGEST	
Astronomic Computations for Night Flights	100
Hydraulic Press for Testing "SbGM" Flexible Hose	103
A Repair Stand for Fuel Pumps	106

POOR ORIGINAL

REVIEW AND BIBLIOGRAPHY

V. Polyak - Textbook on Air Navigation	111
New Books on Aviation	119

YOUR DECISION?

What Decision was taken by the Pilot?	123
How has the Navigator Determined the Course?	124

I SOLVED ...

What should the Pilot do?	127
To Determine the Energy of the Atomic Nucleus	128

AVIATION ABROAD

G. Starko - Bacteriological Warfare	132
Aviation Chronicle	144